SCIENCE

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CONTENTS:

THE ORIGIN OF SPECIES BY MUTATION.*

FORTY years ago Darwin's 'Origin of Species' was given to the world. The number of those who witnessed its appearance gradually diminishes year by year. Few are left to remember the condition of things at that period, and the shock which its publication caused. We had grown up firmly convinced of the invariability of species. The precepts and commands of Linnæus reigned supreme over our thoughts and deeds alike. To take the last specimen from a locality, no one would have dared, not even in the seclusion of the forest primeval. Far less would any one have had the temerity to give even a single thought to those phenomena whose study he had forbidden. Many an interesting variation did I meet with on my walks when a student, but, obedient disciple that I was, left uncollected.

With the appearance of Darwin's book came the complete overthrow of the old doctrine. What formerly had been *the* science now became merely its primer. New demands were made upon investigation, interest was now directed into entirely new channels. An endless field was

* Address before the second general meeting of the eighth congress of the 'Nederlandsche Natuuren Genuskundige Vereeniging,' held at Rotterdam. Translated from the 'Album der Natuur,' Mei, 1901, by H. T. A. Hus, Assistant in Botany, University of Amsterdam, and revised by the author.

opened for thoughts, for observation, or comparison and the drawing of conclusions. The result was a hard-fought war, openly carried on against Darwin, and ending in his complete victory. But before we were able to declare ourselves advocates of the new doctrine, the bonds which held us were to be severed, and we had to break loose from the old prejudices.

Of the present generation none have known this internal struggle. They have been brought up in the new doctrine. The common descent of species and genera is for them a dogma, as much as the creation of species was for their fathers. With different eyes they watch the progress of science in this new territory. They neither feel the pride of the victor, nor have they the personal example of Darwin's untiring labor. It is much to be regretted that everywhere, in the manner of both working and thinking, we find evidence of this. Deductive treatment has taken the place of observation and investigation. An immense superstructure of speculative science has risen on the foundation of Darwin's selection theory. The possible influence of selection in past times has been discussed for numerous cases, but its actual influence at the present time was left uninvestigated. Thought, instead of Nature, became the source of theory, and the latter consequently became farther and farther removed from the truth.

At last the tide is turning. Conn, in a recent book on evolution, exclaims: 'Let us leave our books and return to Nature,' adding, 'leave speculation and turn to observation.' The necessity of this is making itself felt everywhere. The time of contemplation is past. We no longer ask how things *might be;* how things *are* is the question of the hour.

De Varigny, the well-known French translator of Wallace's book on 'Darwinism,' formulates as the first requisite, viz., that we should see species originate. It is no longer sufficient to be convinced that it is so, we must know it from experience. During the last decade a few investigators have sought the paths which lead to this goal. It is but recently that the results they obtained have been published. And though the paths followed are very divergent, and the results differ greatly, yet for all the initial point was Darwin's book; none were influenced by subsequent speculations. Darwin's theory of adaptation led to the investigations on the origin of species in the Alps by Kerner and von Wettstein; Darwin's selection theory to the statistical investigations of variability by Galton and Weldon, and to the mathematical studies of Karl Pearson. And likewise finding its origin in Darwin's great work, stands the study of discontinuous variability, the study of the single variations or mutations,* and the question whether in these must be sought the origin of species.

Only a single case has been discovered in which it is possible to actually see species originate; and this not accidentally, but experimentally, so that one can watch and carefully follow the manner of their origin.

Three kinds of evening primroses occur in Holland, all three introduced from America about a century ago, but since escaped from cultivation. The youngest of the three, or rather the one most recently introduced, and at the same time the most rare, is the large-flowered evening primrose, described at the beginning of the nineteenth century by Lamarck, and named after him *Oenothera Lamarckiana.* It is a beautiful, freely branching plant, often attaining a height of five feet or more. The

* Sudden variability, comprising the deviations from the rules of heredity in the wider sense, as opposed to fluctuating variability, *e. g.*, the degree of variability peculiar to each character of a species. Hugo de Vries, 'Die Mutationstheorie.' Leipzig, Veit & Co. 1901.

branches are placed at a sharp angle with the erect stem and in their turn bear numerous side branches. Nearly all branches and side branches are crowned with flowers, which, because of their size and bright yellow color, attract immediate attention, even from a distance. The flowers, as the name indicates, open towards evening, shortly before sunset, and this so suddenly that it seems as if a magic wand had touched the land and covered it with a golden sheet. Bumble bees and moths, especially those of *Plusia gamma* and of *Agrotis segetum*, are the principal visitors. During the hot weather the flowering period is limited to the evening hours. In daytime often nothing is to be seen but faded and half-faded flowers and closed buds. Each flower bears a long style with four or more stigmas, which protrude at some distance above the eight anthers, and would therefore, as a rule, not be fertilized without the help of insects. When the flowers, including their apparent stem, the calyx tube, drop off, there remains behind a perigynous ovary, which finally becomes a capsule. At first green, it becomes brown on ripening and finally opens with four valves, setting free the seeds. A stem with ten to twenty, or even thirty or forty, capsules is not rare, nor consequently a plant with a hundred or more fruits. And since each fruit contains more than a hundred seeds it would be quite possible for a plant of this species to reproduce itself several thousandfold, provided all seeds could germinate and grow.

It is this plant, *Oenothera Lamarckiana*, which exhibits the long-sought peculiarity of producing each year a number of new species, and this not only in my experimental garden, but also when growing wild. But in the latter case the new species have as a rule but a very short lease of life; they are too weak and too few in number to survive in the struggle for existence with the hundreds and thousands of their fellows. In the experimental garden, however, they can be recognized at an early stage, and with especial care may be isolated and cultivated. It is thus that in the experimental garden we are readily able to see that which, among wild-growing plants, is lost to observation.

The new species vary but little from the old. An inexperienced eye detects no difference. Only a careful comparison shows that here we have to deal with a new type. There are some, for instance a dwarf species, and species with a peculiar close crown (*O. nanella* and *O. lata*), which at once attract our attention, because they are short of stature. Again, some are more slender and delicate, others low and unbranched, or robust and tall. A difference may be detected in the shape of the leaves, their color and their surface. The fruits vary in the same manner; sometimes they are long, sometimes short, sometimes slender, sometimes stout. The more one observes these plants, the more differences one sees. Gradually it becomes apparent that here we have to deal, not with a chaos of new forms, but rather with a series of sharply defined types. Each of these types originated from a seed produced by the parent species, growing wild, and fertilized in the usual manner, or growing in the experimental garden, and fertilized artificially, with its own pollen.

Here then we have our first result. The new species originate suddenly, without preparation or intermediate forms. But they do not differ from the old species like an apple from a pear, a pine from a spruce, or a horse from a donkey. The deviations are far smaller. But every one knows how difficult it is to distinguish the common oak from *Quercus sessiliflora*, or the lime tree from *Tilia grandifolia*. Yet these are forms which by the disciples of Linnæus are recognized as true species. And what

botanist has not been entangled in the species of *Hieracium,* or who is able to recognize at first sight the closely related forms of *Cochlearia?*

Because of the dying out of intermediate forms, more ancient species may be widely separated. On the other hand, more recent species, whose ancestors are still alive, may form narrow groups because of and with these surviving ancestors. Good illustrations of the latter are yielded by roses, willows and brambles, as shown by the facility with which the closely related forms can be cross-fertilized, as well as by the great trouble the numerous bastards cause in determination. Such genera are found everywhere in the plant kingdom; the gentians of the Alps, for instance, or the *Helianthemums,* which with us seem to be composed of fairly distinct types. Everything indicates that in these cases the species are of more recent date, and that only through the dying out of intermediate forms the differences between the remaining ones have attained that degree of distinctness which so greatly facilitates the separation of the other groups.

In this regard the *Oenotheras* agree exactly with what may be observed in nature. Recent forms group themselves around the mother form with minute, hardly perceptible gradations.

Once formed, the new species are as a rule at once constant. No series of generations, no selection, no struggle for existence are needed. Each time a new form has made its appearance in my garden, I have fertilized the flowers with their own pollen and have collected and sown the seed separately. The dwarf forms produce nothing but dwarfs (*O. nanella*), the white ones nothing but white ones (*O. albida*), the *O. gigas* nothing but *O. gigas,* the red-nerved ones nothing but corresponding specimens. But a single form made an exception. This was the small *O. scintillans,* the seeds of which produced but a percentage of *scintillans* plants, but here this inconstancy is and was as much the rule as the constancy of the other species.

As an example I may cite *O. gigas.* The plant is as tall as *O. Lamarckiana* but has a more robust stem, denser foliage, a broader crown of large, widely opening flowers and stouter flowering-buds. The fruits attain but one half the length of those of plants of the mother species and consequently contain fewer seeds. But the individual seeds, on the other hand, are rounder, fuller and heavier. This type originated in my cultures of 1895 as a solitary specimen, which at first was overlooked. At that time I desired to hibernate some plants, and in the latter part of the autumn chose for that purpose twelve of the strongest and best developed. It was only in the following summer, when the plants began to flower, that I noticed that one plant showed differences, the importance of which I did not fully realize until the fruits, on ripening, became much shorter and stouter than ordinarily was the case. It was only then that I placed the raceme in a bag so as to prevent fertilization with other pollen. Afterwards this seed was collected separately and in the spring of 1897 sown in a flower bed between other beds sown with seeds of the normal *Oenothera Lamarckiana.* Immediately subsequent to germination no difference was apparent, but when the third and fourth leaves unfolded it suddenly became evident that a new species had originated. All plants differed from their neighbors, were more robust and bore broader, darker leaves. Though two to three hundred in number, all evidently belonged to one distinct type. Not having, at the time, paid special attention to the mother plant, I was unfortunately unable to compare the latter with the type at this age. But when, during the summer, first the stems and

afterwards the flowers and the fruits, made their appearance, the agreement became perfect. All specimens closely resembled the mother, and together they formed the new species, *Oenothera gigas*. This species therefore was at once constant, even though it found its origin in but a single specimen. Evolved with a sudden leap from the mother species, differing from it in general appearance as well as in the character of its various organs, it remained unchanged. It was no rough cast which selection had to correct and polish before it could represent a distinct form; the new type was at once perfect and needed no smoothing, no correction.

My other species originated in the same manner, suddenly and without transitions. We may therefore assume that species, when growing wild, do not appear gradually, slowly adapting themselves to existing conditions, but suddenly, entirely independent of their surroundings. Species are not arbitrary groups, as Bailey, and with him many others, believed should be deduced from the theory of descent, but sharply defined types, unmistakable, for one who has once seen them.

Each species is an individual, says Gillot, having a birth, a lease of life, and an inevitable death. From the moment of birth until the time of death, it remains the same. Only when taking this point of view can we reconcile our daily experience of the constancy of species with the theory of descent. This is fully confirmed by the results of my experiments.

If species originated gradually, in the course of centuries, their birth could never be observed. Were it so, this most interesting phenomenon would forever remain hidden from us. Happily it is not so. Each species as soon as born takes its place as peer in the ranks of the older species. This birth may be directly observed. One can even collect the seeds in which the new types are hidden, and one can observe the first steps in the development of these types. Literally the new species originates at the time of the formation of the seed, but it is born only at the time of germination. But at this period it is not recognizable as such; this only becomes possible after the first leaves have unfolded. The plant can then be photographed, and in this manner we may preserve the type as soon as it becomes discernible and recognizable. In fact, one can study the birth of a species as readily as that of any individual, be it plant or animal.

Yet it shows one important difference. It is not at all necessary that a species should originate in but a single specimen as we saw in the case of *O. gigas*. The same leap, the same mutation may occur again, and actually did so in my experiments, where, in fact, it seemed to be the rule. All that is required is that the cultures consist of some thousands instead of some hundreds of specimens. Two things then become apparent: First, that in each lot several specimens of *O. nanella, O. lata, O. oblonga* and of certain other new species appear; secondly, that it is only a few types (and no others) which make their appearance. The number of new forms is far from unlimited. On the contrary, but few types make their appearance annually, and this among a large number of specimens. There are some that are more rare, as for instance *O. gigas* and a most graceful, small-flowered mutation which put in an appearance during the past year. In the latter, unfortunately, the seeds did not ripen, and therefore, for the present at least, it has disappeared, leaving no trace, with the exception of a plate, a few photographs and some alcoholic material.

To give a general view of the whole course of my experiments on mutation in

this genus, I might combine them in the form of a

GENEALOGICAL TREE OF OENOTHERA LAMARCKIANA.

Generations:	*gigas*	*albida*	*oblonga*	*rubrinervis*	*Oenothera. Lamarckiana*	*nanella*	*lata*	*scintillans*
8th Generation, 1899 Annual.		5	1		1700	21	1	
7th Generation, 1898 Annual.			9		3000	11		
6th Generation, 1897 Annual.		11	29	3	1800	9	5	1
5th Generation, 1896 Annual.		25	135	20	8000	49	142	6
4th Generation, 1895 Annual.	41	15	176	8	14000	60	63	1
3d Generation, 1890–1891 Biennial.				1	10000	3	3	
2d Generation, 1888–1889 Biennial.					15000	5	5	
1st Generation, 1886–1887 Biennial.					9			

O. Lamarckiana forms the main stem; all other species originated from its seeds. Descendants of the mutations are not included in the scheme, so as not to make it too intricate.

The first two generations showed but comparatively few types. The reason for this may be sought in the fact that at the time I did not know how to trace them. Hence the fourth generation shows a marked improvement, which continued after the sowing had undergone a great numerical reduction.

O. oblonga appeared by hundreds. All of these plants closely resembled each other. They could be recognized as rosettes of root leaves by the narrow leaves with broad veins, and later on by their delicate, stiff, nearly unbranched, seemingly naked stems. The same is true for the dwarf forms. Our genealogical tree shows of these about 150; in other experiments I have met with even larger numbers. These plants again form a distinct type, which could readily be recognized, whatever the age of the specimens. *O. rubrinervis*, *O. albida* and *O. scintillans* were far rarer, but as a rule appeared each year, always bearing exactly the same character.

A species therefore is not born only a single time, but repeatedly, in a large number of individuals and during a series of consecutive years.

It is clear that this fact, so apparent in my experiments, must be of enormous importance in the case of wild-growing plants. How small is the chance of a single plant to triumph in the struggle for existence! Only when a number, or rather a large number, of similar individuals do battle together for the same cause is it that this chance acquires a value. *O. gigas* would have been nipped in the bud were it not for my aid. I have never found it growing wild, as I did some specimens of the less rare *O. lata*, and *O. nanella*. But these also meet with too many hardships. Only once have I found a single specimen in flower.

But next to the question of the more or less frequent appearance of a new species stands another which has as potent an influence upon its life. It is of course a matter of pure chance whether a mutation is or is not better adapted to the environment than the parent species. Sometimes it will go one way, sometimes the other, or both may be equally well adapted. Our *O. gigas* and *O. rubrinervis* are, during the flowering period, as robust as the mother

species. Perhaps the first is, because of its broader leaves and stouter stem, a little better adapted. Probably both would survive in the struggle for existence if the early stages were not detrimental. *O. albida* and *O. oblonga,* on the other hand, are extremely weak, and it is with great difficulty that they can be persuaded to produce flowers and fruit. When growing wild they could never survive, in fact, they are never met with, though in the garden experiments they made their appearance in large numbers. For *O. nanella* the form is an objection, at least, under existing conditions, though were these different, it might prove an advantage. In regard to *O. lata,* which until now I have hardly mentioned, the plants are low, with a limp stem, bent tips and side branches, all very brittle, but with dense foliage and luxuriant growth. But unlike its relations, it possesses no pollen. It is true there are apparently robust anthers, but they are dry, wrinkled and devoid of contents. Only by cross-fertilization can *O. lata* produce seeds, and so it is unfit to found a wild type. Certain structural characters of this plant are therefore detrimental, or at least useless, and 'useless characters,' as every one knows, were among the earliest objections to the doctrine of the gradual origin of species by selection. For this theory can explain none but useful characters.

These observations are also important from another point of view. They teach us that the variability of species is independent of environment. This hypothesis, already formulated by Darwin, and which for him was the basis of a simple, logical explanation, is fully confirmed by the results of our experiments. Before Darwin published his 'Origin of Species,' it was generally believed to be otherwise; it was thought that environment had a direct influence on species. Changes in environment would call forth various needs and these in their turn would cause gradual changes in various organs. Use would have a strengthening, disuse a weakening, effect; a functioning in a certain direction would fit the organ better for that function. The changes would take place gradually and imperceptibly, but if only the influence continued long enough in one direction, specific differences would finally appear. On this theory are based the attempts already mentioned to make new species by transporting lowland plants to the highlands and *vice versa.* When this is done, great modifications may be observed, even during the first year. In the Alps the plants assume the compact, woody, small-leaved form which we meet with there so frequently; in the plains they are tall, with slender stems and ample but delicate foliage. At first it appears as if these experiments bore out the general opinion, but Bonnier has shown the opposite. He has proved that it is nothing but adaptation, something which any plant can show and which stands in no relation to heredity and the origin of species.

In my experiments the mother species mutates in all directions, in nearly all organs and characters as well as for better or worse. These changes occur, as far as could be learned, on a poor sandy soil as well as on heavily manured garden soil, with careful treatment and plenty of room between the plants. The mutation therefore is independent of environment, its direction is not governed by circumstances. Numerous species originate at the same time, forming a group in the same manner as the above-mentioned genera. The question which of these will persist in the wild state, which, as legitimate species, will some time form part of our flora, does not concern us at present. This can only be decided when the new forms have lived next to the others for a prolonged period, as some of them have done for the last

fifteen years. For sooner or later must begin the struggle for existence, and the species which is best adapted will come out triumphant. But it is not a struggle between individuals, as is commonly believed, but war between species. The question is whether *O. gigas* or *O. rubrinervis,* or perhaps *O. nanella* or some other species will be best adapted to the new environment. Only then will be decided which shall remain and which shall go.

Here we have elimination of the weak, selection of the strong. 'Many are called but few are chosen.' In Nature this is true of species as well as of individuals.

The development of the entire plant kingdom points to a gradual progress. Nature passes from simple to complex, from generalities to particulars, from the lower to the more highly organized, from species with few characters to those which possess a countless number. Are our mutations a step forward in this direction? I believe I am able to answer this question in the affirmative, if we except perhaps *O. lata,* which possesses feminine characters only, and the dwarf forms, whose type is too common.

It is exactly because of this peculiarity that I arrive at this conclusion. Dwarfs constitute the only type which is also met with among other species, a type which is found among a large number of plants, such as dahlias, chrysanthemums, ageratums and a long list of species belonging to the most widely divergent families. A dwarf form is therefore nothing new, it is but an old principle under a new guise. The same is true for so many other forms which in horticultural and systematic botany are dignified by the name of variety. White varieties are found among most red- or blue-flowered species; with hirsute or thorny species occur nearly as many glabrous or thornless forms. Such repetitions are evidently no progress. They contribute largely to the great variety of Nature, but are usually retrogressive and not progressive changes. And ordinarily they deviate from the species in but a single character, something indicated as a rule by the name.

Quite different from this are the mutations of *Oenothera.* Recognizable as seedlings, as rosettes differing in shape, edge and color of the root-leaves, and later with stems differing in structure and mode of branching, agreeing in the flowers, varying in the fruits, they possess a type entirely their own, a type quite novel. Neither in other species of this genus nor in other genera belonging to the same family, nor anywhere else in the plant kingdom, do we find a *rubrinervis* or an *albida* with all their distinctive characters. Here we have something absolutely new, something entirely original.

My observations constitute but a first step in a new direction. But that direction is the one demanded by the times.

Any advance in our knowledge depends on the possibility of seeing species originate. Of course this does not refer to present species. Such a thing would be as impossible, as absurd, as expecting to witness the birth of an individual already inhabiting the earth. The species living at present are too old. But they may give rise to new ones. There seems to be sufficient reason for suspecting that this is happening at this very moment, and in our immediate surroundings, only we are not aware of it. Such cases must therefore be searched for with great care and patience. Once found, they must be carefully and extensively studied. The one case which I have mentioned here shows sufficiently the great treasure of new facts which lies within our reach. All that is necessary is to overcome the first difficulties.

Not only would such studies aid the theories of science, but they would also be

of great advantage to the practical side of life. Our improved agricultural plants may serve as an illustration. According to Hays the produce of entire districts may be increased ten per cent. by the careful and repeated selection of seed. And these results were reached by the aid of old methods, applied during a few years only. How great is the promise of the new methods, with their larger prospects and greater chances.

Next to new races are new species. Let this be the motto of science and practice alike, for the welfare of agriculture as well as for the welfare of man.

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SIXTH ANNUAL MEETING OF THE NEW YORK STATE SCIENCE TEACHERS ASSOCIATION.

THE meeting was held December 27 and 28 in the Medical College of Syracuse University. The greater part of two half days was given up to the section meetings which are reported at the end of this article. There were also four general meetings. Friday evening was devoted to a dinner and social reunion, an innovation appreciated by all.

The following papers were read and discussed in general sessions:

The Value of Research Work in Education: Professor SAMUEL J. SAUNDERS, Hamilton College, Clinton.

All education which attains its highest ends is of the nature of original research. The power to apply the research method should be raised to as high efficiency as possible before we stand face to face with the problems of life; it should be cultivated during the whole school career. Much of our modern educational effort fails because the pupil does not test his knowledge continuously and learn 'to do by doing.' The research method in science trains the observation, the imagination and the memory. It increases manual dexterity and skill. It forces the student to stand on his own merits and makes of him a vital factor in the promotion of civilization and national prosperity.

The Study of Types: Professor N. A. HARVEY, Chicago Normal School.

A full abstract of this paper is printed in *School Science,* beginning with February, 1902.

The Report of the Committee on 'A standard College Entrance in Botany,' appointed by the Society for Plant Morphology and Physiology. Presented by Professor FRANCIS E. LLOYD, Teachers College, Columbia University.

This report is discussed in a recent number of SCIENCE (page 409).

Symposium, *What ought the high school teacher in each science to know? What ought he to be able to do? What are his opportunities for self-improvement?* Brief speeches by several members and guests.

Report of Progress of the Committee on Stimulants and Narcotics: Presented by the Chairman, Professor IRVING P. BISHOP, Normal School, Buffalo.

The report comprises: I., A comparison of text-books used in medical colleges and in the public schools of the state; II., opinions of the committee regarding the effects of alcohol; III., opinions of educators regarding present methods of teaching physiology; IV., conclusions of the committee from the preceding investigation; V., recommendations of the committee. The report urges that the state law be modified so as to give more freedom to the writers of text-books and the teachers of physiology 'to decide as to the character and content of their teaching.' It urges that less time be spent in trying to teach the physiological

effects of alcohol and tobacco, and more time in a treatment of the question from the moral and economic standpoint. The report is signed by Professor Irving P. Bishop, Buffalo Normal School; Dr. Burt G. Wilder, Cornell University; Dr. Gaylord P. Clarke, Syracuse University; Dr. Eli H. Long, University of Buffalo; James E. Peabody, Peter Cooper High School, New York.

Alcohol Physiology in the Public School: Professor W. O. Atwater, Wesleyan University, Middletown, Connecticut.

Professor Atwater, after disclaiming any desire to have his own experiments or any set of experiments taught in the schools, when there is so much of great importance to teach in the way of conclusions, said:

The amount of teaching of temperance physiology and the space given to it should be much less than is required by the legislation of a considerable number of states, including your own. The kind of teaching should be that which agrees most closely with the attested principles of physiological science; that which is both scientifically and pedagogically most reasonable. This, in my judgment, means a material modification of the legislation in many states, and an equally important change in the character of a large amount of the text-book instruction. These changes I believe to be called for in the interests of sound science, sound pedagogy, sound morals and effective temperance reform.

He would have some of the time and space now devoted to alcohol physiology given to the subject of food and nutrition in general, since a large part of preventable disease is due to errors in diet.

Referring to the state laws again, he said: Thus it comes about that we have in the United States a great educational movement which is attempting to build moral reform upon a basis of scientific doctrine which the best scientific authority disapproves.

Perhaps the matter has not occurred to you in just this light before, but is not this a fair statement of the case?

A large and increasing number of men of science are coming to realize that scientific error has found its way into the curricula of the schools and are earnestly considering what shall be done to correct it. A large and increasing number of intelligent and conscientious teachers are coming to feel more and more deeply the harm which comes from what they consider to be false science and wrong pedagogical methods, and are earnestly considering how they may be freed from the responsibility of the teaching and the children in their care may be freed from the harm that it brings. Over and against this is a great body of people, profoundly interested in education and morals, tremendously earnest in their self-sacrificing efforts to promote temperance reform, convinced that the present teaching is called for and proper, and determined that it shall be enforced. There is a clash between physiologists and teachers on the one hand and moral reformers on the other. Both seek the same end. They differ as to method.

After discussing the literature of alcohol physiology, and his own experiments, he presented his conclusions, a few of which follow:

We should not teach that alcohol is a food in the sense in which that word is ordinarily used. We should not teach that it is a poison in the sense in which that word is ordinarily used. We may say, and with truth, that alcohol in large quantities is poisonous, that in large enough doses it is fatal, and that smaller quantities taken day after day will ruin body and mind. But it is wrong to teach our boys that alcohol in small quantities, or in dilute forms in which it occurs in such beverages

as wine and beer, is a poison in the ordinary sense of the word. In all that we say on this point we must bear in mind that the intelligent boy knows well, and as a man he will know better, that people have always been accustomed to moderate drinking, as it is commonly called, and yet live in excellent health to good old age. If we tell him that alcohol in small quantities is poisonous in the sense in which he understands the word, he will see that we are exaggerating, that we are teaching for effect, and he will instinctively rebel against the teaching. We may say, and say truthfully, that the moderate use of alcohol is fraught with danger. But the cases where the occasional glass leads to excess are the exceptions. If we present them to the thoughtful boy as the rule or the common result, he will detect the fallacy and distrust the whole doctrine. We may be right in saying that alcohol often does harm to health when people do not realize it, that it prepares the system for inroads of disease, that there is a graduation of injury from forms scarcely perceptible to the utter ruin of body and soul. But to present the 'horrible examples' as a common result of drinking is illogical in itself, contrary to right temperance doctrines, and hence injurious to the children we teach. For that matter I believe the picturing of the frightful results of vice to young and innocent children is more harmful than useful. We ought not to teach that alcohol in small quantities is harmful. Still more should we avoid saying that it is commonly beneficial. Some of us as individuals may believe that its use in small quantities is generally desirable, but there is nothing in either the facts of common experience or in the results of scientific inquiry to justify the inference as a general principle. It is under some circumstances a valuable nutriment in the sense that it can yield energy to the body, but not in the sense that it can build tissue. It is under other circumstances a poison in the sense that it is injurious to health. When taken in large enough quantities and for long enough time it is destructive to life. It is sometimes very useful and sometimes very harmful, but the harm that comes from drinking, in many communities, vastly exceeds the good.

While we cannot deny to alcohol a nutritive value, that value is very limited. In yielding energy to the body, it resembles sugar, starch and fat, though just how and to what extent it resembles them experimental inquiry has not yet told us. It differs from them in that it does not require digestion and is hence believed to be more easily and readily available to the body. It is not stored in the body for future use like the nutrients of ordinary food materials. The quantity that may be advantageously used is small. If large amounts are taken, its influence upon the nerves and brain is such as to counteract its nutritive effect and it becomes injurious in various ways. And finally there are many people who begin by moderate use and are led to disastrous excess. Alcohol may be useful to one man and harmful to another. One may take a considerable amount without apparent harm while another may be injured by very little. One may use it habitually without injury, while another may not. In sickness it may be a priceless boon, but it may likewise be the cause of physical, mental and moral ruin. The boy or the man, as long as he is in good health and does not need alcohol or medicine, is in general better off without it.

In speaking of the Connecticut school physiology law, the speaker said, in substance:

The last Connecticut Legislature repealed the former law, which, though less objectionable than those of some other states, including New York, was felt by

nearly all the leading educators in Connecticut to be too stringent. It was replaced by one which requires temperance instruction in a smaller number of grades, none being called for in either the primary grades or the high school, and leaves the character of the text-book and the kind and amount of instruction wholly to the decision of the school authorities. This change was brought about by a fortunate cooperation of the teachers and temperance organizations of the state, including the state branch of the Woman's Christian Temperance Union; though it was vigorously opposed by Mrs. Hunt of the Department of Scientific Temperance Instruction of the National W. C. T. U. The speaker believed that the example of Connecticut might well be followed in New York and other states.

In conclusion, Professor Atwater said: We wish to help the drunkard to reform; but is it necessary to tell him that no man can touch alcohol without danger? To build up the public sentiment upon which the reform of the future must depend, we wish our children to understand about alcohol and its terrible effects; but when we teach them in the name of science shall we not teach them the simple facts which science attests, and which they can hereafter believe, rather than exaggerated theories, whose errors, when they learn them, will tend to undo the good we strive to do? In short, is not temperance advisable, even in the teaching of temperance doctrine?

In the great effort to make men better, there is one thing that we must always seek, one thing we need never fear—the truth.

After a long and animated discussion, in the course of which the statements of Dr. Atwater and the committee were challenged by Mrs. Mary Hunt, of the National W. C. T. U., and a number of her followers, the report of the committee was adopted and the committee was requested to continue its work for another year.

The following are the officers for this year: President, Professor William Hallock, Columbia University; Vice-President, Professor Howard Lyon, Oneonta Normal School; Secretary-Treasurer, A. R. Warner, Auburn High School. Executive Council, Professor Edward S. Babcock, Alfred University; Professor H. J. Schmitz, Geneseo Normal School; William M. Bennett, Rochester High School; Professor James H. Stoller, Union University; Principal Thomas B. Lovell, High School, Niagara Falls; Professor W. C. Peckham, Adelphi College, Brooklyn; Professor A. D. Morrill, Hamilton College; Professor E. W. Wetmore, State Normal College, Albany, N. Y.; Professor H. R. Linville, Boys' High School, New York City; Mr. Charles N. Cobb, Regent's Office, Albany; Professor J. H. Comstock, Cornell University, Ithaca; Professor E. R. Whitney, Binghamton High School.

Franklin W. Barrows.

Section of Physics and Chemistry.

This Section was in charge of Professor J. M. Jameson, Pratt Institute, Brooklyn, N. Y. Two sessions were held and each was well attended. At the session on Friday afternoon, December 27, 1901, Professor Charles B. Thwing, Syracuse University, read a paper on 'The Preparation and Training of the Teacher of Physics,' and Dr. Lyman C. Newell, State Normal School, Lowell, Mass., read a paper on 'The Preparation and Training of the Teacher of Chemistry.' Professor Thwing emphasized the necessity of broad and accurate training in physics and a wide knowledge of the salient points of contact of the other sciences with physics. Dr. Newell dwelt upon the need of a better knowledge of the fundamental facts of

chemistry, the desirability of original work, and the necessity of more attention to the application of psychology to the laboratory work. At the session on Saturday morning, December 28, 1901, Mr. J. R. Kittredge, Union Classical School, Schenectady, N. Y., read a paper on 'The College Entrance Preparation of Students as Viewed from the Secondary Man's Standpoint.' Professor Charles M. Allen, Pratt Institute, Brooklyn, N. Y., discussed 'Chemical Laboratory Notes,' and Mr. F. M. Gilley, High School, Chelsea, Mass., read and illustrated a paper on 'How to Meet the Problem of Teaching Physics by the Laboratory Method in Secondary Schools.' Mr. Kittredge made a plea for a four years' course in science with physics as the basis, Professor Allen illustrated his plan of presenting experiments and recording notes by the 'loose-sheet method,' and Mr. Gilley by two experiments illustrated his method of teaching a large section as a whole. The papers were discussed by the members of the Section, and a healthy interest was shown in the one thought of the meetings, viz., how to secure better teaching.

Reported by

LYMAN C. NEWELL.
STATE NORMAL SCHOOL, LOWELL, MASS.

EARTH SCIENCE SECTION.

The Earth Science Section met on Friday afternoon, December 27, and on the morning of Saturday, December 28.

At the first session the subject for discussion was the question of 'Geography for Training Students in the Normal Schools.' Discussion was opened by four twenty-minute papers given by Professor A. W. Farnham, of the Oswego State Normal School; Professor C. Stuart Gager, of the New York Normal College, Albany; Principal C. T. McFarland, of the Brockport Normal School; and Professor W. S. Monroe, of the State Normal School, Westfield, Mass. The first two speakers paid particular attention to the work in physical geography that should be presented to normal students who are intending to teach in the elementary schools; the last two speakers emphasized particularly the human side of the work as it should be presented, Professor Monroe outlining at some length what to his mind should be included in such a course in reference to the races of men and their conditions and characteristics as related to their environment. All speakers agreed on the necessity of more time for geography work in the normal schools of New York State, and particularly for better coordination of the work, so as to secure more efficient geographical training.

The second session was devoted to the discussion of the preliminary report presented by the Committee of Seven appointed in 1900 to outline a course in physical geography for the secondary schools of New York State. Mimeographed copies of the report of the committee and of the course suggested by the committee were in the hands of all who attended. After a brief presentation of the main points of view held by the committee the discussion was led by Head Inspector C. F. Wheelock, of the Regent's Office; Professor A. P. Brigham, of Colgate University; and Miss Elizabeth E. Meserve, of the Free Academy, Utica. Informal discussion under a five-minute rule followed, and was participated in by many of those present.

Both sessions were particularly helpful and suggestive, and great interest was shown in the problems presented for discussion. At the close of the meeting it was voted to ask the Association to continue the Committee of Seven for one year, with the expectation that it would, at the end of that time, present a series of laboratory exercises for Physical Geography in Sec-

ondary Schools, and a Course of Study for Elementary Schools.

Richard E. Dodge,
Chairman.

Teachers College,
Columbia University.

NATURE STUDY SECTION.

The program for this section was designed to bring out the opinions of those present on the training that a teacher should have in order to teach nature study. The first session was devoted to papers and discussions on these matters, and the second session to the relating of personal experience by teachers actually engaged in carrying on nature study work successfully in their schools.

The speakers were all present and the discussions were taken up with much vigor and interest. We agreed that the basis for successfully teaching nature study lies in an interest in the subject, a belief in its educational value in the broadest sense, and in a certain amount of personal experience with nature itself. That more training is desirable, if added to the above essentials, was admitted by all.

Miss Hill, Miss Carss and Professor Bardwell showed how much could be done by trained nature students in the instructing of both children and teachers. But it was shown by Miss King, Miss Whittaker, Miss Mershon, Mr. Round and Mr. Drum that special science training is not absolutely necessary to carry out the spirit of true nature study.

Mr. Beach, in presenting his plan for teachers' classes made practical suggestions which recommended themselves to all. No doubt many such classes will be formed during the coming year in cities. Mention was made of the correspondence course for teachers, conducted by the Bureau of Nature Study at Cornell University. Teachers were urged to make use of every available opportunity to increase their knowledge of subject matter, not in order that they may teach facts, but in order that they may teach their pupils how to learn from nature.

Mary Rogers Miller,
Chairman.

Cornell University.

SECTION OF BIOLOGY.

Four papers were read and discussed:

The Preparation of Secondary Teachers in Biology: Professor F. E. Lloyd, Teachers College, Columbia University.

The high school is the 'college of the people' in a wide sense and worthy of the best efforts of well-educated and trained teachers. Owing to the inadequate preparation of many teachers the present work in biology shows a lack of uniformity in ideals, unevenness in the quality of instruction, and a remarkably heterogeneous high school course, taking the country as a whole. Those preparing for the profession of secondary teaching in biology should hold the bachelor's degree, and should have studied physics and chemistry. In biology they should have earned at least nine points credit before graduation, one third of which should have been in botany or zoology. Following this course of study they should have a professional training, including psychology, history and principles of education, special study of the problems of the high school and a course in the theory and practice of teaching biology in secondary schools. This latter course embraces two parts: (*a*) Theory, consisting of lectures and reading on the history and aims of the teaching of biology, on courses of study, topics, etc.; (*b*) practice, consisting in observation of teaching, construction of a course of study and examination of available materials. This course culminates in a season of actual teaching under skilled criticism. During the course the

candidate should pursue advanced work in botany and zoology.

Such a course may well be made to lead up to the conferring of degrees coordinate with those of law and medical schools and equal to them in significance.

What the Teacher of Botany in Secondary Schools should be Prepared to do: Dr. A. J. GROUT, Boys' High School, Brooklyn.

Ideals in Teaching: Professor A. D. MORRILL, Hamilton College, Clinton, N. Y.

In the modern teaching of natural history one of the first ideals to hold sway was taxonomy, then, the study of types, and, later, the investigation of physiological processes. At present no single ideal is in vogue. Along with these more or less clearly conceived general ideals there have grown up minor ideals which often are of an extra-scientific nature. Trimming the principles of biology to meet the exigencies of a set examination is a spectacle often seen in our midst.

In elementary work the pupil is of much greater importance than the subject, but many teachers think more of the symmetrical presentation of their subject than of creating in the minds of their pupils a liking for science. A similar blindness to proper methods leads other teachers to dull all the interest of discovery by giving preliminary lectures and demonstrations which make the laboratory period one of uninteresting verification.

The ideal best calculated to help the young pupil to break away from the dominating authority of books is the one that leads him into the paths of nature so that he comes upon the truths himself.

Well-directed work in biology develops individuality and independence in judgment. The example of one earnest, interested and independent student in a class is not less successful than that of the instructor in bringing indifferent workers into line.

The Training of a Science Teacher for Secondary Schools: Professor N. A. HARVEY, Chicago Normal School.

A teacher of science in a high school ought to know: (1) His subject, (2) the psychological movements involved in learning the subject, (3) the principles and the art of teaching.

Without knowledge of the subject matter, as complete as possible, no substantial progress can be made. But the teacher must not pursue one line of research to such a degree as to become one-sided, lest he attempt to drill his pupils in the methods of the trained investigator.

If the teacher would avoid the use of men's methods in trying to develop children's minds he must have more than a theoretical knowledge of the general laws of mental action. He must bring the mind of the child into the presence of truth in such a way that its activity will be aroused and growth will result.

Under the prevailing limitations, the normal schools do not properly train teachers for the high schools. Neither do colleges and universities offer an ideal preparation for the science teacher. The latter are occupied too exclusively with the idea of storing up knowledge, with little or no consideration of the psychology of the process.

There are three alternatives for securing better trained teachers: (1) Normal schools may modify their courses to meet the demands for high school teachers; (2) universities may change courses in pedagogy by introducing practice in teaching; (3) the science teacher may get the knowledge of his specialty in the university and his pedagogical training in the normal school.

HENRY R. LINVILLE,
Chairman.
DEWITT CLINTON HIGH SCHOOL, NEW YORK.

THE FUTURE OF VEGETABLE PATHOLOGY.*

On this occasion, as president of the Ohio Academy, it is incumbent upon me to deliver an address, presumably upon some phase of the body of knowledge we call science. Custom points no less unerringly to some topic along the lines of one's chosen pursuit. Doubtless, without any announcement a botanical heading would be assigned to this occasion. For various reasons it has seemed fitting to present to you some thoughts on 'The Future of Vegetable Pathology.' Certainly this cannot be done without considering the history of the rise and progress, nor without discussing the present status of plant pathology from the standpoint both of the investigator and of the teacher. These matters are likely to lead to estimates concerning the rank of vegetable pathology among the divisions of botanical science. Concerning the speaker personally, it is known to most of you that his pursuits are along the line of the study and investigation of plant disease.

Since it is in the cultural aspects of plant life rather than in the original condition of wild plants that pathology has claimed the largest attention, we naturally look to that phase for much of its history. The advance of our knowledge in this helpful line has certainly been gratifying during the closing decade of the nineteenth century.

Plants, as dynamic factors, exhibit certain general and normal activities discernible under widely different conditions of environment, and recognizable in plants of external dissimilarity; the study of these normal activities leads us to plant physiology. At the same time these plants in their usual activities are impinged upon by certain special and general phases of environment, by varying climatic conditions embracing differences in the amounts of heat, light and humidity, exposure to dryness in air or soil, as well as the encroachments of animal life by the cropping of herbivors or the fretting of insects. In response to continuously acting stimuli of this character the plants become modified or adapted to the conditions surrounding them; the study of this adaption leads to ecology.

Studying still these same plants as living organisms, and either in their general functional activities or in their external and internal adaptations or in both, we find that the course of life of the plant is by no means always normal—instead of simple turgor we may have intumescence or edema (dropsy, as our physicians would say); instead of the free water flow contemplated through the conducting tissues we may find the vessels closed. Not only this, external and internal parasites may attack any and all organs of the plants, intercepting light and heat, absorbing, destroying or diverting the usual nutritive substance, penetrating and transforming essential organic tissues, and even totally preventing the attainment of the reproductive functions; these parasites may lie in wait in the soil, be wafted in the winds or be sown with the seed of the husbandman. Otherwise incapable of striking expression by external signs, the plant may find itself fixed in a soil with inadequate or unsuitable or even injurious substances contained therein; accordingly there is stunted growth, reduced vigor or manifest ill health indicated by fruit or foliage. Abnormalities are seen in such and in other ways; their study just as certainly leads us to vegetable pathology.

Pathology is then at least tentatively ranked coordinately with physiology and ecology among the divisions of botanical science which have to do with plants in their life relations. No one of these divisions just enumerated, more than an-

* Presidential address before the Ohio Academy of Science, November 29, 1901.

other, may be successfully cultivated without some knowledge of the other divisions of botany and of allied sciences.

Historically, vegetable pathology has been studied for a long time; at least one work on 'Maladies des Plantes' has a title page date of the early fifties. Of two German works in the nature of general treatises on this subject, still useful, the first editions were issued in the years 1874 and 1880, respectively: I refer to the handbooks of Sorauer and Frank, both of which have passed through subsequent editions. The lamented Winter's little work, 'Die durch Pilze verursachten Krankheiten der Kultur Gewachse,' belongs to about the same period (1878). These were followed by almost synchronous publication of works by Prilleux, Hallier, Tubeuf, Berlese and Marchal in French, German and Italian, respectively. Tubeuf's book was soon translated into English by Smith, and its appearance in that dress has been followed by the handbook of Massée, and by the recent and most excellent work by H. Marshall Ward under the title 'Disease in Plants.'

There are journals too, including the *Zeitschrift für Pflanzen-krankheiten,* edited by Sorauer, now in its eleventh volume, the Zweite Abtheilung of the *Centralblatt für Bakteriologie und Parasitenkunde,* now in its sixth volume. The Italians have the *Rivista di Patologia Vegetale,* of many years' standing, edited by Berlese, and the Dutch the *Tidschrift over Planten Ziekten* edited by Ritzema-Bos. In England society proceedings and journals have been the chief avenues of publication for work on plant diseases; while in the United States, aside from the *Journal of Mycology* instituted by Dr. Kellerman while in Kansas, now no longer published, the publications of the United States Department of Agriculture and of the various experiment stations in the several stafes have been the chief agencies by which a large and valuable literature on plant diseases has been issued.

Looking at the subject in this manner, we are led to conclude that plant pathology has possessed a well-arranged and systematic body of facts bearing upon the subject, during a period of at least twenty years, and that this body of knowledge has been accessible for that length of time in the form of published handbooks; and further that it has possessed, and still possesses, a large literature issued in periodical form and covering the multitudinous phases of the subject in question.

Has plant pathology meanwhile assumed the coordinate rank herein indicated along with plant physiology and ecology? I fear we must answer negatively in so far as college professorships and university courses are concerned. Aside from the few universities which offer rather brief undergraduate courses in 'vegetable pathology' or in 'plant diseases,' most, or I might say all, American university and college courses offered by well developed botanical departments, consisting of two or more chairs in botany, are silent on this subject.

If the elements of the subject are taught at all they are presented under either plant physiology or the systematic study of fungi, and it is notable that in America's oldest and largest university this division of botany is not recognized as existing. Professor Ward, to whom reference has already been made, responds in a recent letter that his work in plant diseases is all research work and that he offers no separate course upon the subject.

It is easy to understand that up to a recent time no well formulated call had been made for students equipped in this line, and that therefore no demand existed for courses in plant pathology, but certainly the recent expansion in experiment station work, and in that of the United States De-

partment of Agriculture, no longer leaves this position tenable. The writer has sometimes wondered whether we have in this tardiness to apply botany in vegetable pathology a sort of unwillingness or reluctance to place applied science upon a coordinate basis with pure science. Many are aware how relentless was the opposition of the representatives of the old education to putting engineering or applied science courses upon the same basis as the arts course for graduation. Indeed, if I am not mistaken, certain institutions still discriminate against graduates in engineering. Seeing that all this is history, and noting that applied science in the domain of living things offers great difficulties by reason of the variations in the organisms themselves than the sciences applied in engineering and other technological lines, it ought not to surprise us that this applied botany should make at times slow advances. Such has been the case all along the line of agricultural application. It would not be against some things that have already passed into history were the lingering, or inherent hostility to useful knowledge as a part of the subject matter of collegiate instruction to have had something to do with the tardy recognition given to plant pathology in this, the foremost country of the earth, in the application of the remedial methods its study has brought to our people. A good many of us have heard the sneer often accorded to really fine work in applied botany.

However much weight we may give the foregoing considerations, it must not be denied that vegetable pathology as a well-rounded division of botany has been compelled to pass severe tests, to suffer disadvantages.

The tendency in some quarters to restrict the application of the term vegetable pathology to a study of the cryptogamic parasites upon plants has been a great drawback. Parasitology has been developed to the narrowing and dwarfing of the true science. Doubtless this is the idea which finds expression in the catalogued courses of 'economic mycology.' One well-known and liberal-minded botanist, himself a professor of botany, made the remark to me some two years ago that he would acknowledge that we possessed a science of plant parasitology, but that the science of plant pathology seemed to him to require building up on the non-parasitic side before we could consider it a well-developed division of the science of botany. I may mention here in passing that the development in this country of economic entomology, apart from botany, wherein its application rests if it attain economic rank as to plants, has also divided forces when compared with the course of events in Germany and the remainder of Continental Europe.

Granting that the immediate demands for it and the recognized value of the results of the study of fungus parasites have developed the science unequally or disproportionately in that direction, recent advances have certainly tended in a large measure to correct this tendency. While we do not yet know the exact interrelations out of which harm results from the unlocking of oxidizing enzyms at unpropitious times, as is now believed to be true in yellows of the peach and in the mosaic disease of herbaceous plants, notably of tobacco, progress towards a knowledge of this abnormal 'stoffwechsel' has certainly been rapid and has apparently proceeded along safe lines. That many normal processes in plants remain obscure or unsolved does not discourage the plant physiologist; no more should the obscurity of the abnormal deviations cause the plant pathologist to desist from his triumphant progress.

A prominent plant physiologist has recently asserted that an adequate explana-

tion of so simple and fundamental a process as the ascent of sap in plants yet remains to be proposed; other problems in physiology are stated to be equally unsolved. In a like position the vegetable pathologist finds himself with respect to some of the problems of pathology. Unsolved problems there are, and unsolved problems there will remain so long as men continue yearly to extend the boundaries of our knowledge of plant life.

I feel well assured that the state of our knowledge warrants us in recognizing plant pathology as a well-established division of botanical science entitled to the coordinate rank I have earlier indicated. If this be granted then what reasonable grounds exist to warrant the arrangement of courses and the establishment of chairs of vegetable pathology? I think the basis of our modern education affords us but one answer. The state charges itself with educational matters in order that her citizens may be more useful in perpetuating the state and in contributing to its welfare and prosperity. The state is already demanding the services of those who are capable of assisting agriculture by controlling the diseases of culture plants; with the lapse of years these demands promise to develop in increasing proportions.

The institutions of learning which leave their graduates without all the training for this work that the state of our knowledge affords are missing one of the fairest opportunities for usefulness. The graduate who finds that his notes on economic mycology fail to connect his parasite adequately with the changes in its host, will probably accuse his instructor of leaving him to find out for himself what he should have been taught in some manner, at least, while he had a student's leisure and before the unceasing demands of actual service pressed upon him. Generally speaking, American institutions leave the student in this position, or offer him an excellent opportunity to make his own pathological inferences from physiological instruction. In my judgment, the demand for well-considered instruction and research in plant pathology is already formulated and only awaits avenues of expression to make itself felt. It would seem that the land grant colleges and state universities are situated at a great advantage by their opportunities, in the line of courses in a pathological botany that shall be pedagogically sound and actually immediately helpful. They have this fine opportunity because of their relations to the state at large and to the agricultural community in particular, and by either direct or contributory connection with the experiment stations and the United States Department of Agriculture. Have such courses been made prominent and are these great institutions realizing their full opportunities? And are the time and facilities in the way of helpers allotted in our state university or elsewhere, such as make nothing more to be desired? To both of these questions most would give either a qualified or an unqualified negative answer. So long as this is true much remains to be done for the future of vegetable pathology. It may be added that so far as my own inquiries and those of certain of my friends have extended, we find plenty of disposition to create separate chairs in botany in our universities, and properly so, but there is little manifest disposition to provide for instruction in plant pathology. If we contrast this apparent indisposition—I say *apparent* advisedly, for those on the outside can judge as to what is being considered within only by announcements—if, I repeat, we contrast this apparent indisposition of the institutions training the future physicians of the plant world with that existing in medical colleges wherein there

is a very concrete division of pathological subjects, we are forced to conclude that a great deal remains to be done to provide adequately for the future instruction that I am well assured is to be given in vegetable pathology.

A body of well-organized knowledge on plant diseases presented by teachers charged chiefly or solely with the giving of courses or the conduct of investigations in plant pathology is, I am led to believe, not solely by the course of demand for workers, but as well by the development of our agriculture practice, to be the future of vegetable pathology. In so far as I am aware, the only university whose officials have, as yet, expressed a desire and future purpose to put plant pathology on this foundation for the future is not, as one would expect, endowed by public funds, but by private philanthropy. I am hopeful that this will not long remain the case.

In choosing this subject and in the manner of presenting it, I have been guided, as herein set forth inadequately, by a desire to make plain the disproportion between the demands, in the line of applied botany, made upon many of the most competent graduates in botany and in the preparation they have been given for this work. It is recognized that at no other period of the world's history have the universities of the time been subjected to such stress and expense in equipping for the demands of instruction as have fallen upon those of our own day within the last two decades, more especially within the last one. Under these circumstances, with the achievements of applied physical and chemical science in the minds and on the lips of the inhabitants of both town and country, it is not surprising that the equally important economic achievements in botanical science, and especially in pathology, should have been passed without much consideration by a great number whose interests and training lead them to look elsewhere. What has been stated has been offered in the spirit of friendly suggestion and with no desire to misstate or misapply the facts as they now exist. Should this appear to have been done, it will be my greatest pleasure to make corrections.

It is quite generally recognized at the present day that some of the brilliant hopes of the chemist respecting improvement in plant growth have failed of realization, and that after all the sciences which deal with living things have their problems worthy the most competent and best equipped of our scientists. The chemist will now admit that mere chemical analysis of the plant substances gives no adequate knowledge whereby we may solve the vexing problems of plant nutrition, valuable and helpful as the analysis has been. We as botanists, are justified in the faith that our beloved science is at last to come into possession of her full heritage of problems as well as opportunities. Certainly the unrivaled development of American botany in recent years justifies a faith of this sort.

I have thus with hasty preparation, and, as I am well aware, very imperfectly as to result, taken this much of your valuable time in discussing what appears clearly to me to be the larger possibilities of the future of vegetable pathology.

Augustine D. Selby.
Ohio Agricultural Experiment Station,
Wooster, Ohio.

SCIENTIFIC BOOKS.

Briefwechsel zwischen J. Berzelius und F. Wöhler im Auftrage der königl. Gesellschaft der Wissenschaften zu Göttingen. Mit einem Commentar von J. von Braun; herausgegeben von O. Wallach. Leipzig, Verlag von Wilhelm Engelmann. 1901. Two vols., 8vo. Vol. I., pp. xxii+717, with portrait of Berzelius; Vol. II., pp. 774, with portrait of Wöhler.

Thanks to the great care with which the

persons addressed preserved the letters received, and to the circumstance that this was the habit of both parties, chemists can now examine the voluminous correspondence maintained by the Swedish master Berzelius and his famous pupil Wöhler, throughout a long period of years (1823–1848). After the death of Berzelius, Wöhler presented the letters received from him to the Royal Academy of Sciences of Sweden with the condition that they should be kept secret until January 1, 1900; and Berzelius' widow sent the letters written to him by Wöhler to the same institution, whence they were afterwards transferred to the University library of Göttingen. The two large volumes reproducing these letters are published under the auspices of the Royal Academy of Sciences of the same town.

The correspondence begins with a letter written by Wöhler from Heidelberg, July 17, 1823, stating that the eminent professor of chemistry at Heidelberg, Leopold Gmelin, had suggested his applying to Berzelius for permission to continue his chemical studies in the laboratory of the distinguished Swede. At that date Wöhler had published four researches that may have been known to Berzelius, the first in 1821, when Wöhler was twenty-one years of age, narrating his discovery of selenium in a Bohemian mineral and in the oil of vitriol manufactured therefrom. Berzelius replied favorably and a few months later Wöhler made the journey to Stockholm, where he passed the winter of 1823–24. The last letter in the work was written by Svanberg to Wöhler on August 8, 1848, and announced the death of Berzelius; the intervening letters depict the intimate relations that existed between the two chemists.

The high opinion formed by Berzelius for his young pupil was fully justified when, within four years of his studentship, Wöhler was able to write to his former master of his brilliant discoveries of aluminium and of urea; the first in a letter dated October 10, 1827, and the second in a letter of February, 1828. To these announcements Berzelius answered with enthusiasm, 'Aluminium and artificial urea, truly very different bodies, following so close to each other, will be the precious gems in the laurel wreath woven for thy brow.'

Besides their personal successes in chemistry the friends wrote to each other of the labors of their contemporaries and friends; the Swede wrote to the German of the discoveries being made by Mosander, who had been nicknamed 'Father Moses,' of the claims of Gay Lussac, of his opinion of Gerhardt, and of various domestic and family matters.

On the other hand, Wöhler had many things of interest to communicate; he wrote of his joint investigations begun with Liebig in 1830, and in the same year of his marriage. In 1832 the letters are full of incidents; Liebig discovers chloroform and chloral, Faraday discovers voltaic induction, Wöhler's wife died (in 1834 he married a second time), Liebig received a visit from Wöhler in Giessen and they began to investigate bitter almond oil.

Events then marched rapidly; in 1835 Berzelius visited Paris, and Wöhler journeyed to London, after which the two met in Bonn and traveled together to Cassel. This meeting was a source of great pleasure to both the friends, who now pledged themselves in brotherhood (*bruderschaft*); they met but once again in life, at Göttingen in 1845.

In 1836 Wöhler received a call to Göttingen, Berzelius married and was made a baron; in 1837 Bunsen investigated cacodyl, and the unfortunate quarrel between Berzelius and Liebig began with an attack by the latter.

Among the innumerable items of value in these 1,500 pages, one may be cited of special interest to American chemists. In June, 1833, Wöhler wrote to Berzelius that a young American, a pupil of Silliman, had been studying with him for some months, and in December of the same year he again mentions him, this time by his name, Booth, and says he wishes to continue his studies under Berzelius if he (Booth) can obtain permission. In this connection Wöhler writes handsomely of the American's ability, industry and absolute trustworthiness. Those who remember the late Professor James Curtis Booth, for forty years melter and refiner in the United States Mint of Philadelphia, and in 1883, 1884 and

1885 President of the American Chemical Society, will be pleased to note the accurate forecast of his character made by Wöhler fifty years before. Booth, however, did not go to Sweden, as Berzelius replied he was too old to take charge of any students.

The reviewer can give but a birdseye survey of the extraordinary value of these volumes as contributions to the history of chemistry. An index of proper names adds to their usefulness.

Henry Carrington Bolton.

Reports of the Cambridge Anthropological Expedition to Torres Straits, Volume II. *Physiology and Psychology.* Part I. 'Introduction and Vision.' Cambridge, The University Press. 1901. 4to. Pp. 140.

The inclusion of psychological tests in the anthropological survey of the status of primitive peoples is a noteworthy tendency of recent investigation, and one worthy of the highest commendation. No more interesting contribution of this nature has been made than the one just published by the Cambridge expedition, the general director of which is Mr. A. C. Haddon. The psychological observations are due to W. H. R. Rivers. While many of the observations are rather undeveloped in type and made under unfavorable conditions, yet the whole research embodies a considerable amount of material that is suggestive even where it fails to be conclusive. Mr. Rivers is entitled to great credit for the inauguration and the successful completion of this series of tests.

The direction of such an enterprise involves great tact, a constant watchfulness for sources of error, encounter with difficulties of language and the explanation of what was wanted. The men had to be given tobacco and the children sweets as rewards of merit for having their eyesight tested, while at the same time an appeal to their vanity was very efficacious. The story was circulated that the black man could see and hear better than the white man, and that the white man had come to see whether this was so and would record the results in a big book for all to read. An overzealous native, in impressing the necessity of truthfulness in answering the questions asked, had hinted that Queen Victoria would send a man-of-war to punish those who told lies, and so frightened off a group of subjects altogether. But on the whole, Mr. Rivers presents satisfactory evidences that the natives understood what was desired and were able to give proper attention to the test.

Only a few of the more significant results can here be presented in outline. Visual acuity was tested in several ways, the best being by the use of the letter E in various positions (Snellen's Haken). This character was presented in various sizes and arrangements and the subject required to hold a sample character, which he had in his hand, in the position of a given character exhibited at a standard distance. The smallest size of the character distinguishable at the standard distance would thus be a measure of the visual efficiency according to the usual procedure. In one group of natives there were two thirds who had vision between two and three times what is commonly supposed to be normal European vision. This conclusion must be somewhat modified in view of the difficulty of obtaining precisely comparable European standards and in limiting the subjects to those presenting no decided refractive defects. Yet the balance of evidence is in favor of a slight superiority of the vision among 'Naturvölker' as compared with 'Culturvölker.' Bringing this into relation with the widely circulated reports of the marvelous visual powers of savages, Mr. Rivers decidedly agrees with those who interpret such proficiency as, in the main, a psychological one. It is because the savage in his limited world knows what to look for, that he is able to recognize objects at a greater distance; and when the European attains an equal familiarity with the environment he is likewise able to observe what previously passed his closest scrutiny. Mr. Rivers cites a case in point from Ranke who was astonished that the Indians (of South America) 'could tell the sex of a deer at a distance which would have implied vision at an extremely small angle if the distinction had depended on seeing the antlers,' but who found that he could make the like distinction

when once he had noticed the characteristic difference of the gait in the two sexes. Likewise Mr. Rivers' Papuans, though they possessed a superior vision, yet detected the presence of a steamer in a neighboring harbor mainly by knowing what to look for at so great a distance. A few supplementary results may add interest to this general conclusion. It appears that the women had as good vision as the men, that decline of vision seemed to set in at an earlier age among the Torres Strait natives (æt. 35) than among Europeans (æt. 50), and that they, furthermore, did not exhibit the rapid improvement with a given test which is a common observation among Europeans. Myopia was distinctly less common than among Europeans, and this alone would account for an average superiority of visual acuteness. It appeared, too, that the natives could see more clearly with feeble illumination and were able to distinguish the faint gray rings produced by slight black patches on a rotating white disc (Masson's discs) better than Europeans.

Mr. Rivers' examinations of the color sense were quite extensive and included some very interesting notes on the color vocabulary in the several native languages. The relative absence of the typical form of color blindness (confusion of reds with greens) among the people examined corroborates the result found by others, that color blindness of this type is distinctly more prevalent among European peoples. Mr. Rivers gives strong reasons for concluding that his subjects exhibited a certain degree of insensitiveness to blue (and possibly green) as compared with Europeans. The result, in a measure, strengthens Gladstone's contention of the relatively late introduction of blue in the color evolution of the race, but it gives that conclusion a different and far more rational setting. A third group of visual experiments related to the space perceptions and the sensitiveness to certain common illusions of length and direction comparisons. Here a brief résumé is hardly possible, but suggestions of interest are the following: the well-known Mueller-Lyer illusion (of the apparent greater length of a line having divergent pairs of oblique lines at its extremities, like the feathering of an arrow, above an equal line with convergent oblique terminations) is distinctly less marked to the Torres Strait natives than to Europeans; the former are relatively less variable among themselves in judgments of this type than a comparable group of Europeans; several other illusions involving interpretative factors were less marked than they would be to Europeans, while a few that depended upon the physiological shortcomings of the eye seemed on the whole more obvious than to uninstructed Europeans.

Many of these suggestions offer tangible points of corroboration or the opposite, of general notions as to the effect of civilization upon the sensory endowment of man. Mr. Rivers throws out the pertinent thought that a superiority of minute sensory observation may well be the characteristic of the more primitive mind, and that this form of excellence may be prejudicial to the more general use of the senses as the servants of the judgment and associative interpretation upon which education depends. He suggests that the less marked sensitiveness of his subjects to certain illusions may be an evidence of this, since they see only the parts and not the whole; and it is the conception of the geometric figures as a whole that brings in the contrast upon which the illusion depends. "If too much energy is expended on the sensory foundations, it is natural that the intellectual superstructure should suffer. It seems possible that the overdevelopment of the sensory side of the mental life may help to account for another characteristic of the savage mind. There is, I think, little doubt that the uncivilized man does not take the same æsthetic interest in nature that is found among civilized peoples." And this, according to Ranke, is due to the savage absorption in the useful details of nature and his consequent inability to see the larger relations. "Ranke's experience is strongly in favor of the view that the predominant attention of the savage to concrete things around him may act as an obstacle to higher mental development."

We are as yet far from an adequate view of the essential transformation of the psycholog-

ical equipment that has been concomitant with the transition from primitive to civilized conditions. It is equally certain that many of the current notions as to the likenesses and differences of 'Naturvölker' and 'Culturvölker' rest upon presuppositions rather than upon proper observation. Such researches as this of Mr. Rivers bear the possibility of clarifying our views as to these interesting relations.

JOSEPH JASTROW.

MADISON, WISCONSIN.

Monograph of the Coccidæ of the British Isles. By ROBERT NEWSTEAD. London, Ray Society, 1901.* Vol. I. Pp. 220, Pls. A–E, and I.–XXXIV.

This is the first comprehensive work on the British Coccidæ and is the result of over ten years' study by the author, who is the foremost authority on scale insects in England. The term 'British' is permitted to have a very elastic meaning, since all species found living in Britain are included—even those on hothouse plants and on fruits in the market. Thus, the *Diaspis* of cacti is duly given a place, though nobody would think of treating the cacti themselves as members of the British flora. Indeed, of the thirty-eight species discussed in the volume, only six are genuine natives of the country. This peculiar interpretation of the term 'British' is wholly justifiable when we consider the fact that many of the most injurious coccids are those which have been introduced, and indeed those most commonly met with are found in hothouses on imported plants. If Mr. Newstead had confined his researches to the indigenous species, his volume would have been of comparatively small practical value to the British coccidologist or horticulturist; and as the mode of occurrence of each is precisely stated there need be no confusion. Of the thirty-eight species, no less than thirty-one have also been taken in America, so it will readily be seen that the work is of much importance to us in this country. Every species is carefully described, and there are beautiful colored plates of most, as well as line drawings illustrating the minute structural characters. Biological facts of the greatest interest are recorded. The genus *Aulacaspis,* of the present writer, is accepted, but defined by entirely new characters. It results from this that it includes a quite different series of species from those hitherto referred to it, except, of course, that the type species (*A. rosæ*) remains as before. I find, upon renewed study, that this new interpretation is apparently correct, and it marks a considerable advance in classification. *Aulacaspis* is now seen to be an Old World genus, while *Diaspis* is mainly American.

The common mussel-scale of the orange is referred to *Mytilaspis pinnæformis,* but I think incorrectly. The insect of this name occurs on orchids, while that of the orange (*M. beckii*) has never been seen by me on these plants, though it might be common on orange trees with plenty of orchids growing near, as is the case in Jamaica. We have to do, perhaps, with a case of 'physiological species,' and there is an opportunity for some one to try experiments in transferring the coccids from one plant to another.

Altogether, the work is a very admirable one. The only serious fault I find is that the author has not taken sufficient pains to examine the literature of his subject. Thus, he often quotes Cooley's paper on *Chionaspis,* and yet failed to learn from it that the so-called *C. salicis* of this country is not identical with the European species. The statements about the exotic distribution of the species are frequently incomplete, and sometimes inaccurate. In several cases, names are cited in the synonymy which were never printed in the places cited; thus Leonardi wrote *Aspidiotus (Selenaspis) articulatus,* but Newstead cites it *Selenaspis articulatus,* treating the subgenus as a genus in the synonymy, though he himself regards it as only a subgenus.

T. D. A. COCKERELL.

EAST LAS VEGAS, N. M.

* It may be useful to state that the actual date of publication was the middle of December, 1901.

SOCIETIES AND ACADEMIES.

NEW YORK ACADEMY OF SCIENCES.

SECTION OF GEOLOGY AND MINERALOGY.

THE regular meeting of the Section was held Monday evening, March 17, with Dr. A.

A. Julien, chairman, presiding. This being the annual meeting of the Section, the first business of the evening was the election of officers for the ensuing year. Professor R. E. Dodge nominated Professor J. J. Stevenson for chairman and Dr. E. O. Hovey for secretary. On motion of George F. Kunz, W. H. J. Sieberg was directed by unanimous vote of the Section to cast one affirmative ballot for the nominees. He did so and they were declared elected.

The following program was then offered:

George F. Kunz made an exhibition of specimens illustrating the finding of epidote, grossularite, garnet and twinned crystals of quartz of the Japanese type, associated with chalcopyrite, malachite and other ores of copper in a contact vein in limestone in the Green Monster Mining Co.'s mine near Solzer, Prince of Wales' Island, Alaska.

'The Centenary of John Playfair's Defense of James Hutton's Theory of the Formation River Valley': Memorials by Professors J. J. Stevenson, J. F. Kemp and R. E. Dodge.

Professor Stevenson, after speaking of the conditions prevailing in British geology prior to the publication of Hutton's memoir in 1785, gave briefly the characteristic features of Hutton's doctrines, and accounted for the ease with which his work could be misunderstood and misinterpreted. He described the conflict to which the memoir led, and emphasized the bitterness of those who opposed the doctrine on theological grounds. The preparation of Playfair's work was due as much to a desire to defend Hutton as to support his theory. Playfair appealed to those opponents whose knowledge of the theory had been derived chiefly from attacks made upon it. For them he showed that the theory was beautiful, symmetrical and in no sense inconsistent with the Scriptures. In dealing with the other class of opponent, led by Kirwan and DeLuc, he used vigorous language exposing their ignorance and insincerity, and denouncing the virulence with which they had given a theological turn to the controversy. In defending Hutton's theory, Playfair brought his own great resources to bear, now correcting errors, now elaborating the doctrine, and in some places hardly anticipating some of the great works of later days.

The inviting style gained many readers for Playfair's book, among them Greenough and his associates, who founded the Geological Society of London, that theory might be replaced by observation. Hutton's theory obtained final triumph in 1830, when Lyell published his 'Principles.' Playfair's work hastened the birth of geology as now understood by a full quarter of a century, and finally divorced our science from cosmogony.

Professor Kemp's memorial was more in the nature of a review of Hutton's personal history. He said in part: James Hutton was born in 1826, and, after his school and university course, entered a lawyer's office to prepare for the bar. He disliked the law, however, and gave up the study after a year. Being greatly interested in chemistry, he took up the study of medicine, attending lectures at Edinburgh and Paris and taking his degree at Leyden in 1749. The career of a physician did not attract him much, after all his preparation, and in 1752 he went to Norfolk to learn agriculture. There his mind first turned definitely to mineralogy and geology. In 1754 he settled on his ancestral estates in Berwickshire, where he remained fourteen years, with occasional visits to Edinburgh and more distant parts of the kingdom. In 1768 he gave up country life and removed to Edinburgh to devote himself entirely to the study of geology and kindred sciences. His untiring industry enabled him to accomplish a marvelous amount of work in chemistry and finally to elaborate his essays in geology, revolutionizing that science and, with the elucidation given his work by Playfair's 'Illustrations of the Huttonian Theory of the Earth,' raising it to the high plane which it has occupied ever since. Modern geology dates from the publication in the spring of 1802 of John Playfair's explanation, elaboration and defense of Hutton's theories.

Professor Dodge, in his memorial of Playfair, said in brief:

To James Hutton we owe many fundamental truths now recognized in physiography,

and to John Playfair we owe the elucidation of these ideas, and their amplification.

The doctrine that rivers are the cause of their valleys, and the proof thereof is perhaps the most important foundational idea that we owe to the combined labor of these two geological worthies. Playfair's clear exposition of the possible origin of river terraces, his acute description of the relation of lakes to rivers, his analysis of the varied forms of shore lines, and his emphasis of the importance of initial shore lines, all clearly exploited in his illustrations, deserve to take rank with the much-quoted passage on rivers and their valleys, as being accepted geographical truths far in advance of their time.

After the reading of these memorials the Section listened to two papers by Professor R. E. Dodge and one by Gilbert van Ingen, all of which were illustrated by means of the lantern.

Professor Dodge's first paper was entitled 'An Interesting Landslide in the Chaco Cañon, New Mexico,' and he said in brief:

On a high mesa to the southeast of the Chaco Cañon, and about four miles below Putnam, New Mexico, is a series of stone monuments about five feet high and four feet in diameter. These monuments stand on the edge of rim rocks of an old escarpment three hundred feet high. The rim rock of the escarpment is a coarse brown sandstone capped by about two feet of thin-bedded dark brown sandstone containing sharks' teeth. The face of the escarpment has recently slipped along a series of joints running approximately parallel to face of escarpment, and in a general direction of S. 30° E. The recesses between slipped blocks can be sounded to a depth of over fifty feet, and are wider at base than at top as a rule.

In the slipping an ancient rock hogan twenty feet in diameter has slid 2.5 feet vertically and 8.3 feet horizontally without displacing the rock walls to any serious extent.

The second paper by the same author was on 'Arroyo Formation.' An arroyo is a steep-sided, narrow gulch cut in a previously filled gravel and adobe valley in the arid West.

The study of the process of formation of arroyos, some of which have been under observation for several years, seems to show that the work has changed from aggradation to degradation because of some influence that has caused the focusing of the running water. Such a concentration of water is made possible by over-grazing of the land, which removes the help of roots in holding soil particles, combined with the habit of cattle to move in processions along trails that make a natural channel for water.

The study of the rate of valley-filling or erosion is difficult, because of the tendency of arroyos cut in adobe to maintain nearly vertical walls, and because a fallen block of adobe may be sealed over in the next flood, so that it looks in place. This problem is of especial importance, because the adobe deposits in some places contain relics of human occupation to a depth of many feet. The exact or even the approximate antiquity of the deposits cannot be definitely determined, because of the several ways in which the order of events in such a case may be interpreted.

Mr. van Ingen's paper was on 'The Ausable Chasm,' and gave a description of the geology and physical features of this celebrated locality which incorporated the results of the author's own observations with those which had been arrived at and published by others.

Edmund O. Hovey,
Secretary.

BIOLOGICAL SOCIETY OF WASHINGTON.

The 354th meeting was held on Saturday evening, April 19.

Barton W. Evermann and E. L. Goldsborough presented 'Notes on Some Mexican Fishes,' based upon collections made in Mexico and Central America by Mr. E. W. Nelson, Dr. J. N. Rose and others. Attention was called to the occurrence of a species of Cichlid (*Heros urophthalmus*) in the cenotes or natural wells of Yucatan. These wells occur in a region where there is no surface water, and it is difficult to account for the presence of fish in them.

Mr. Nelson found this same species in salt water at Progreso and Mujeres Island, on the

Yucatan coast. The Cichlidæ are a family of fresh water fishes much resembling superficially our sunfishes (Centrarchidæ), and their occurrence in salt water had not been previously noted.

The discovery of a new species of catfish belonging to the genus *Conorhynchos,* in the Rio Usumacinta was also reported. No species of this genus was previously known from any point north of Brazil.

But the most interesting thing in connection with this bagre was the discovery that it has the habit of oral gestation, a curious habit not previously known to be possessed by *Conorhynchos,* though long known among species of South American and Ceylonese catfishes of the genus *Arius.*

When the eggs are laid they are taken up by the male catfish, who retains them in his mouth until they are hatched.

In the mouth of one of these catfish Mr. Nelson found thirty-nine eggs many of which readily rolled out when the fish was held up by the tail.

The eggs are quite large, measuring about three-quarters of an inch in diameter, and the embryos are well developed.

Another important discovery was the fact that *Girardinichthys innominatus* is ovoviviparous. This is a species of Pœciliidæ (killifishes) and was found by Dr. Rose to be an abundant inhabitant of the Rio Lerma. Its viviparity had not been noted before, nor was the species known to occur elsewhere than about the City of Mexico.

W. W. Cooke spoke on 'Some Untenable Theories of Migration,' stating that there were two theories as to the relative positions held by the individuals of a given species of bird in their winter home as compared with their positions during the breeding season. According to one theory the relative positions were the same, the birds moving southwards as one body, while according to the other theory the relative positions were reversed, those individuals which bred at the extreme north of the breeding range passing over the others, thus becoming the southernmost birds during the winter.

The Maryland yellow throat was given as an example of this latter method of migration, those individuals that breed farthest north going the farthest south in winter while the southern breeding birds remained almost stationary. But even here a complete reversal of position does not take place, for the intermediate breeding birds do not winter so far south as the southern breeder.

The red-winged blackbird, it was stated, did not follow either of the so-called rules and, in fact, each species seems to have a method of migration peculiar to itself, so that no general rule could be laid down that would cover even a large proportion of the different species. In most species, however, a reversal of position does occur during the early spring migration, but this condition does not last long.

F. A. LUCAS.

THE ELISHA MITCHELL SCIENTIFIC SOCIETY.

AT the 141st meeting of the Society, at the University of North Carolina, on April 15, the following papers were read:

'Arsenic Pentachloride': Mr. H. H. BENNETT.

'Copper Deposits of North Carolina': Dr. J. H PRATT.

'Price of Chemicals': Dr. CHAS. BASKERVILLE.

'Non-cellular Differentiation in Embryos': Dr. H. V. WILSON.

CHAS. BASKERVILLE,
Secretary.

DISCUSSION AND CORRESPONDENCE.

SCIENTIFIC TERMINOLOGY.

THE word 'ecology' is not to be found in recent English dictionaries, no doubt because such dictionaries do not profess to include every vagary of incorrect spelling that may find its way into print. But had Mr. Horace White looked up 'œcology,' he would have found it in the best dictionaries of the last fifteen years at any rate. He would not, however, have found the definition that is now given by you, but—to quote the 'Century Dictionary'—"The science of animal and vegetable economy; the study of the phenomena of the life-history of organisms, in their individual and reciprocal relations; the doctrine of the laws of animal and vegetable activities, as manifested in their modes of life. Thus, parasitism, socialism, and nest-building

are prominent in the scope of œcology." Or, as Cassell's 'Encyclopædic Dictionary' (1886) concisely puts it—'The knowledge of the sum of the relations of organisms to the surrounding outer world, etc.' The word was, I believe, coined by Haeckel in his 'Schöpfungsgeschichte,' and must have been introduced into English in the translation of that work, which, being only about thirty years ago, is in a sense 'post-Darwinian' as you suggest. Haeckel and biologists generally have used the word in the above sense, but of recent years the botanists have wrested, or at least restricted, the meaning of the term to the study of the associations of plants in such groups as alpine, sand-dune, and desert plants; and this is the sense intended on pp. 458, 459 of SCIENCE for March 21. In a word, they have used 'œcology' instead of 'œcological plant geography.' This is rather different from your editorial explanation, which seems to apply equally to what pedants call 'chorology.' Perhaps I may refer those who wish to be interested to a clear and concise paper 'On the Study of Plant Associations' by Mr. Robert Smith in *Natural Science,* for February, 1899, though he does not mention the word 'œcology.' The botanists have about as much right to alter the meaning of the word as they have to alter its spelling. But the deed is done, and perhaps that is why zoologists have tried to replace the word in its original sense by such expressions as 'bionomics' and 'ethology.'

On the general question of scientific terminology (which is a different thing from nomenclature) I take this opportunity of endorsing Mr. Very's sensible remarks, and of recalling two further arguments in favor of a technical terminology based on Greek or Latin. First, its universality, since the words, with but slight modifications to adopt them to the genius of each particular language, may be used whether one be writing Russian or Roumanian, French or English, Portuguese or even German. The more extended the adoption of this technical terminology, the more easily will students of one country be able to read the scientific publications of other countries.

A curious illustration of this is afforded by the very sentence which Mr. T. A. Rickard (SCIENCE, January 24, p. 137) quoted as an abuse of geological terminology, intelligible to 'a traveling dictionary,' but not to the miners for whom it was intended. Without pretensions to fall into either of these categories, I found that the only words I did not understand in the sentence were two adopted from the miners themselves, and far removed from Greek and Latin. Secondly, such a terminology lends itself to the formation of analogous terms, of series of similar terms, and of compounds defining or extending the root-term, in a way that can be rivaled by few modern languages, certainly not by Anglo-Saxon English.

The other side to the question was admirably put by Mr. Rickard in the article already quoted, although he does not seem to discriminate sufficiently between technical scientific writing and the popular exposition of science. Huxley is constantly held up as an example, and those who would like to know how to treat of technical subjects in simple language are referred to 'the course of lectures delivered by Huxley to working-men.' But if Mr. Rickard will turn to Huxley's original scientific writings, he will find technical terms quite as abundant there as in the works of less lucid authors; indeed, every zoologist knows that Huxley took his fair share in the coining of new words. If this be clearly recognized by the readers of Mr. Rickard's article they will do well to take heed to his warning. For there is a temptation, stronger perhaps than ever before, to clothe simple ideas in a far-fetched jargon, and thus to impose on the credulous with a show of learning that hides a poverty or a looseness of thought. That fatal human habit of substituting words for things is made still more easy; and we deceive ourselves, which is far worse than deceiving others. Lastly, a subject of fascinating interest that might attract to the study of science many an expanding mind, or that might win the sympathy of the man whose life-work lies elsewhere (a sympathy which men of science profess to long for), is rendered sterile and repellent by the unnecessary

use of unfamiliar terms. If I may without offense take a concrete instance, I would suggest that the author of the interesting note, 'Ecological Problems connected with Alpine Vegetation' (p. 459), might find it to the advantage of his subject, his audience and himself if he would rewrite his paper without using the words ecology (or œcology), phytogeography, morphology, floristic, edaphic, and xerophyte, or their derivatives.

F. A. BATHER.

BOTANICAL NOMENCLATURE.

TO THE EDITOR OF SCIENCE: It occurs to me after reading Dr. Cook's truly melancholy account of the condition of nomenclature in botany, to point out that the vast majority of the tribulations from which that nomenclature is suffering would be nonexistent if botanists had simply been willing to stand by the rules accepted by practically all zoologists. All the terrible examples he cites from Hernandez drop out of sight at once on the application of the rule that vernacular names are not to be accepted. Ninety-nine hundredths of the rest disappear with the fixation of 1758 ('Systema Naturæ,' Ed. X.) as the date beyond which resurrectionists shall not disturb the tombs.

It is true that all bodies of men contain a certain proportion of freaks and that some may be cited among zoologists, and a certain number of persons who have not made a study of nomenclature as an art, persist in injecting sentimental considerations into their argument and practice.

But these as a rule have not succeeded, in this country, in disturbing systematic work or diverting attention from the goal of stability which most zoologists aim at.

With an international committee to decide the fate of the residue of preposterous names which no rules can eliminate, I think a comparatively few years would put zoological nomenclature on a solid and permanent basis. And if botanists would 'hark back' to De Candolle and rigorously apply his rules, they also might see the dawn of a better day.

WM. H. DALL.

SMITHSONIAN INSTITUTION,
April 26, 1902.

THE WILL OF THE PEOPLE, NOT OF AN OLIGARCHY.

PROFESSOR WILLIAM T. SEDGWICK, of Boston, in an address published in SCIENCE, January 10, 1902, 'confesses with sorrow' the lack of success of efforts to prevent the study of 'temperance physiology' as now required in the public schools of this country.

He first offers in defense of his opposition the fact that Horace Mann, in 1842, did not include temperance physiology in his essay on 'The Study of Physiology in the Schools,' but he omits to add the significant accompanying fact of history, namely, that the recommendations of Horace Mann's essay that 'physiology should be taught in the schools,' aroused in Massachusetts such a storm of bitter opposition from the doctors and men of official science, that the existence of the Massachusetts State Board of Education and its secretary, Horace Mann, were saved by only a hair's breadth from being entirely legislated out of office. But time has vindicated Horace Mann's recommendations, while his opponents are forgotten.

Sixty years have passed and Massachusetts, as well as every state in the United States and the National Congress, has made physiology and hygiene, which latter includes the nature and effects of alcoholic drinks and other narcotics, a mandatory public school study. Professor Sedgwick is now objecting, not to this study, he says, but to the legal specifications which have made it a success. First he objects to its being taught 'to all pupils.' He does not tell when or by what class of pupils he would have it omitted. In our country 'all pupils' of to-day are destined to be the sovereign people of to-morrow. Hence, looked at from the standpoint of the state, it can not afford that one single pupil should not receive the utmost instruction on this subject needed to fit that pupil for a future sovereignty of intelligent sobriety.

From the standpoint of the individual, we ask, From whose child shall this educational method for the prevention of intemperance be withheld? Shall it be from the children of the poor, the rich, the foreign-born or the home-born? We are answered by the command of the greatest of all teachers that the supreme

message for the prevention of evil and the establishment of right should be given 'to every creature' in 'all the world.' That inclusive command and precedent not only justify all pupils getting this education, but imply neglect of duty if it is excluded from any.

If Professor Sedgwick's objection is to the requirement of the study through specified grades, as his reference to the Illinois law implies, we answer:

The formation of right habits is the object sought. The child's habits are rapidly formed, new ones each year. It is therefore self-evident that progressive instruction which will guide in the formation of right habits should be given, especially during the primary and grammar years and the first year of the high school, in order to keep pace with and guide the child's development. The boy or girl who leaves school at any point in the school course with as much knowledge as he can comprehend of the laws of health, including those which warn against the use of alcoholic drinks and other narcotics, has thereby a most valuable equipment for the battle of life.

The diffusion of this knowledge in our country is now as universal as the schools. It does not, we grant, add to the value of brewing stock, but evidence is not lacking that it is proving of great value to the human stock in the increase of health due to better knowledge of sanitary laws, consequent lengthening of life, increased sobriety of the American workman, which sobriety is acknowledged to be one cause of the commercial supremacy of this country in the markets of the world, etc.

Professor Sedgwick says he was 'shocked,' 'much disturbed to find that an author had actually felt bound to weave in a lesson on alcohol with his discussion of the physiology of muscle, of nerve, of digestion, of vision and each of several other sections of the subject.'

Why should not the deleterious effects of alcohol on muscles be taught in connection with the study of the physiology and hygiene of the muscles? Professor E. Destrée, M.D., University of Brussels, by actual experimentation proved that the 'total work product obtained from the muscle with the use of alcohol is less than that obtained without it.' Our boys and girls need to know this fact. Why should not the fallacy of the idea that alcohol is an aid to digestion be pointed out in connection with the hygiene of digestion, when Professor Chittenden (one of the Committee of Fifty) distinctly says of his experiments, 'The results obtained suggest a tendency toward prolongation of the period during which the meat remains in the stomach when alcohol fluids are present'? Why is not the treatment of the physiology and hygiene of the nerves the proper place for pointing out the effects of alcohol upon them when H. J. Berkeley, M.D., of Johns Hopkins University, reported as a result of the experiments he performed for the Committee of Fifty that alcohol 'possesses the quality of destroying the protoplasm of the nerve cells and annulling its functions'? Why not, in teaching the care of the eyes, mention the danger from the use of alcohol when the senior surgeon of the New York Ophthalmic Hospital, editor of the *Journal of Ophthalmology,* says, 'The respectable moderate drinker who never takes too much or oversteps the boundary line of decency, but goes round half full all the time, exposes himself to the risk of losing his eyesight, which in this case is incurable'?

To Professor Sedgwick's complaint that some laws require text-books on this subject for pupils' use and specify the amount of temperance matter they shall contain, etc., we reply:

The tendency of careless, unsympathetic school boards to fail in providing well-graded text-books on this subject, books that contain the matter the law requires taught as one source of information for pupils sufficiently advanced to use text-books on other subjects, induced the National Congress and many states legally to require that such text-books shall be provided. This requirement has led to the preparation of a valuable school literature by men of acknowledged scientific standing and to the revision of nearly all the imperfect books. Why should Professor Sedgwick complain? No one has proved these books inaccurate, nor that their use in the schools

has not contributed to individual and public good. The old, unrevised, ungraded, and therefore unindorsed books contain such teaching as the following, for children in primary grades: 'The tendon of Achilles is the tendon of the gastrocnemius and soleus muscle,' a statement as clear as mud to the primary child. The people want better books for their children and hence have so legislated that better books are produced.

Professor Sedgwick further charges me with being a follower of the teachings of Sir Benjamin Ward Richardson, M.D., of London (whom he styles an 'able but erratic physician') and with being 'the creator of this astonishing movement' for temperance education. The late Dr. Richardson was not only a Doctor of Medicine, but a Doctor of Laws and Fellow of the Royal Society and held many offices of distinction. I happened to have had enough previous study in chemistry to enable me to appreciate the reports of his experimental work on alcohol, and no one has proved his findings inaccurate. Although I never saw Dr. Richardson, he taught me much which I have tried to pass on.

As to being the 'creator' of this movement, I do not deny nor apologize for having tried to serve my country through helping to get this education for its children. But I hasten to say that without the aid of the hundreds of thousands of consecrated women in the Woman's Christian Temperance Union, the organized motherhood of this and other lands, whom it is my fortune to represent in this matter, without the cooperation of the good men in this and other countries, in the National Congress, state legislatures and parliaments, every state in the United States would not now have a temperance education law nor would the movement have become, as Professor Sedgwick admits, world-wide.

Professor Sedgwick, in referring to Commissioner Harris' connection with the advisory board of this department, says: 'As to the propriety of the commissioner's connection with this movement I make no comment.' The advisory board of this department consists of eleven members, six of them physicians, three of whom are professors in medical colleges, three men eminent in education and two in ethics. The committee from this advisory board, whose duty it is to examine and pass on text-books, consists of five of the physicians mentioned above, one of the educators, two representatives of ethics, and the Superintendent of Scientific Temperance Instruction of the World's and National Woman's Christian Temperance Union. Dr. Harris, the National Commissioner of Education, and Dr. Barrows, President of Oberlin College, members of the advisory board, are not on its text-book committee. Hence there is no occasion for Professor Sedgwick's subtle reference to Dr. Harris' position on this board. The American people will feel it just and right that their national commissioner of education should be an adviser of a department of education which has been legally adopted by the whole people.

If Professor Sedgwick had quoted entire the recommendations passed by the Superintendents of Schools at their national meeting in Chicago last year, the readers of SCIENCE would have seen that their action was positively on the side of temperance instruction, and not mere 'guarded paragraphs' as he claimed. They repudiated Professor Atwater's teachings of the year before as to alcohol being a food, and put themselves squarely on record on the whole subject as the following paragraphs from their report, not quoted by Professor Sedgwick, show:

"The department of superintendence agrees cordially with the special advocates of the temperance cause in holding that everything which public instruction can do in the battle against intemperance ought to be done, and that both physiology and hygiene should be so taught as to leave in the minds of children and youths an adequate and proper knowledge of the effects of alcoholic drinks, stimulants, and narcotics on the human system.

"Since the last meeting of this department there has been considerable discussion of the question as to whether alcohol under any conditions is properly to be defined as an article of food. Medical authorities are quoted in support of both sides of this question, but no authority has been found to maintain that

alcohol is a food in the ordinary sense of that term. The question of the supposed food value of alcohol is a technical one for medical experts to determine, and not one which needs to concern the men and women who are engaged in the work of public instruction of children and youth. For them it is enough to know that its use as a beverage is injurious, and that all authorities agree in deprecating the formation of the drinking habit and in commending all practicable efforts through public instruction to promote the cause of temperance."

Professor Sedgwick appears to have fears that a writer who desires to publish an elementary text-book on physiology and hygiene, before he can obtain a publisher or a market may have to secure the indorsement of Mrs. Mary H. Hunt, etc.

Anybody can write a text-book on this subject as far as the Scientific Department of the Woman's Christian Temperance Union is concerned, but the mothers in any community have a perfect right to oppose their children studying that book, if, in their judgment, it fails to teach the whole truth against the most destructive of human habits. They have a right through organization to secure and protect this form of education for their children, and to appoint one of their number to act with them in searching for truth, and, aided by men of science, to refuse indorsement to books that do not contain the truth. I make no apology for its being my fortune to have been thus officially appointed, and woe is me if in this I fail in aught of my utmost duty, for history will show that organized motherhood in securing and protecting this education for all the children of this nation has prevented the greatest peril to our government of the people, namely, the lack of capacity for self-government resulting from the use of alcoholic drinks and other narcotics.

As to the publisher's part, I would say in this connection: The publisher is a business man who knows that his success depends upon his supplies meeting the demands of the market. If the condition prevails which Professor Sedgwick describes, it is good evidence that publishers have found that the American people do not want their children to study what the publishers themselves call 'rum books,' and that the indorsement of this department is a guarantee to the public that the books bearing that indorsement are not of that character, but instead contain the truths the people want taught their children. Therefore, the writer who wishes to put a 'rum book' upon the market must find publishers who will ignore the law of supply and demand; or he must persuade the people to allow their children to be sacrificed to the Moloch of intemperance, either for his personal gain or to avoid shocking the sensibilities of scientific gentlemen who see no place in physiology and hygiene for warning against that disobedience of hygienic law which causes, as Gladstone said, more havoc to the human race than war, pestilence and famine.

No man has ever yet been able to present a reasonable argument for opposing the temperance education movement. The brewers and distillers of course can not imagine any other than a financial motive that could induce the devotion and labor that have brought this movement to its present position in this country and the world. Hence they charge, and have from the first, that it is a 'book job.' And in the absence of reasonable objection other opponents reiterate this liquor dealers' charge. Professor Sedgwick falls into line with them when he attempts to support his objection with a quotation from a letter written, he says, by a representative of a publishing house which charges that 'financial benefit' is the motive of the temperance physiology movement. On reading that, I at once wrote Professor Sedgwick asking for the name of his informant and whether that informant had submitted any evidence in support of his statement. Professor Sedgwick replied that he did not feel at liberty to give the name of his informant who, he says, 'did not submit any evidence bearing upon his opinion.' In other words, Professor Sedgwick makes this accusation public without examining the evidence for the same and without knowing, so far as he reports, whether any such evidence existed. If the man who made this charge is reliable, why should he be unwilling that Professor Sedgwick should

mention his name? As to the intimation of a mercenary motive, neither I, nor my advisory board, nor the constituency we represent are one penny richer for the sale of any text-book on this subject bearing our indorsement. Resort to such charges is evidence of conscious poverty of argument against this movement. As to the promoters of temperance education in the public schools being a 'self-constituted oligarchy,' as Professor Sedgwick says, we reply:

The Superintendent and Advisory Board of the Department of Scientific Temperance Instruction in Schools and College represent the World's and National Woman's Christian Temperance Union in their oversight of the study of temperance physiology in schools. Thus this department has for its constituency the largest organization of women in the world, who are banded together to secure, as one of their objects, the protection of this special education for their children. Hence, to call the work of this department that of a 'self-constituted oligarchy,' as Professor Sedgwick does, shows utter misapprehension of facts. 'A self-constituted oligarchy,' *i. e.*, 'power exercised by a few' who are self-appointed, could not write its ideas embodied in law on the federal statute books and those of all the states of this great republic. The laws requiring this study and whatever is necessary to its being taught represent the 75,000,000 American people who have decided that their children shall have this special education. It is simply futile to try to belittle this movement by efforts to make it appear as anything less than a national one which is rapidly becoming world-wide.

MARY H. HUNT.

World and National Superintendent of the Department of Scientific Temperance Instruction of the Woman's Christian Temperance Union.

TEMPERANCE PHYSIOLOGY IN THE PUBLIC SCHOOLS.

TO THE EDITOR OF SCIENCE: Mrs. Hunt apparently sees no impropriety in a law which requires temperance physiology, so called, to be taught to 'all pupils' in the public schools. If it does not seem to Mrs. Hunt, as it does to me, obviously undesirable and improper to require such teaching of children in the primary and kindergarten grades, then I fear that nothing that I can do is likely to bring us into agreement.

Mrs. Hunt has much to say about 'organized motherhood,' by which she seems to mean the so-called 'consecrated women' in the Woman's Christian Temperance Union, and her letter may give the impression that it is not she but they, who have been chiefly instrumental in the text-book movement, etc., especially as she affirms, 'I make no apology for its being my good fortune to have been thus officially appointed.'

Although it is difficult to discover from the context to what exactly she was thus 'appointed,' a reference to Mrs. Hunt's quasi-historical documents cited in my Chicago address, and entitled 'An Epoch of the Nineteenth Century,' and 'A Brief History of the First Decade,' throws light upon this somewhat obscure statement; for upon page 6 of each of these documents Mrs. Hunt states that the 'Woman's Christian Temperance Union was organized in 1874,' and "In the autumn of 1879 I carried to the annual national convention of the Woman's Christian Temperance Union in session in Indianapolis, Indiana, what the Quakers would call 'my concern,' for thorough text-book study of scientific temperance in public schools as a preventive against intemperance. * * * A standing committee, of which I was made chairman, was chosen. * * *

"The idea of scientific temperance instruction as a part of the regular course of study in public schools was thus adopted by an organization [the Woman's Christian Temperance Union]. * * * Resolutions were passed and action taken which resulted in 1880 in the creation by that organization of a department to work for scientific temperance instruction in public schools and colleges, of which department I was made superintendent. * * *

"While this new affiliation brought neither help in methods nor the financial aid greatly needed for the execution of plans, it did furnish what was still more necessary, an earnest, enthusiastic clientage of active loyal Chris-

tian women, in every part of the country, ready gladly and intelligently to carry out the plans transmitted to them. * * * Napoleon Bonaparte would never have been the Napoleon of history if he had had no army."

Mrs. Hunt's allusion to Napoleon is unfortunate, for how Bonaparte was 'officially appointed' to rule over his army we all know.

I must admit that my term 'self-constituted and official oligarchy' was apparently not strictly accurate; and I confess myself at a loss for the right term; 'monarchy' or 'dictatorship' might perhaps fit the case better, but would probably not meet with Mrs. Hunt's approval; and I find her term 'organized motherhood' also open to objection.

As to the statement, 'Professor Sedgwick falls into line with them [that is the liquor dealers] when he attempts to support his objection with a quotation from a letter written, he says, by a representative of a publishing house,' I desire simply to recall what I actually did say, which was that the letter quoted by me constituted an 'opinion,' merely, the existence of which seemed to me noteworthy and unfortunate.

Finally, I may say that I shall be happy to send a copy of my Chicago address to any one who is unable to refer to it in Science of January 10. W. T. Sedgwick.

SHORTER ARTICLES.

PRELIMINARY OBSERVATIONS ON A SUBDERMAL MITE OCCURRING AMONG THE BIRDS IN THE NEW YORK ZOOLOGICAL PARK.

During the month of February, 1901, four white ibises (*Guara alba*) died in the bird-house of the New York Zoological Park, and neither gross nor microscopical examination showed pathological evidence sufficient to account for the death of the birds, but on beginning to skin a fifth ibis, two peculiar patches were observed on the under surface of the skin on each side of the keel of the sternum. At first glance these looked as a heron's skin does, beneath powder-down patches, where the ends of the tiny quills are plainly visible, all pointing in one direction. A closer examination showed these patches to consist of many hundreds of small mites, close together, all lying lengthwise. A yellowish exudation and a small amount of watery matter was observed in the vicinity of these patches.

During the early months of 1901, a number of other birds died from the ravages of this peculiar pest. Two valuable great-crowned pigeons (*Goura coronata*) showed, besides large numbers of these mites, numerous oval parasites in the red blood-cells. A little blue heron (*Ardea cærulea*) and several Nicobar pigeons (*Calœnas nicobarica*) had congested lungs and large numbers of the mites.

The present winter, only two birds have died from this cause, although the mites have been detected in two living birds. In a white ibis which succumbed, the parasites were smaller and less numerous than in the birds of the same species which died last winter. The second bird which died was a roseate spoonbill (*Ajaja ajaja*), in which the mites were large and numerous.

The mites vary greatly in size and appearance, but the largest individuals are 1.50 mm. in length and about .50 mm. in breadth. Eight five-jointed legs are present, four near each end of the longish-oval body. The most noticeable characteristics are the brownish, probably chitinous, leg-supporting structures which vary in complexity with the size of the individual. In a small specimen these are comparatively simple, while in mites of larger size they ramify into complex structures. Six of the legs bear numerous short hairs, while two at one end of the body end in a single long bristle.

The temperature of the bird-house has been kept quite low during the present winter, with distinctly beneficial results to the birds, and this may also account for the absence or small size of the mites.

Drawings have been made of specimens and, although distinct, the organism most resembles the worm-shaped pigeon mite (*Hypodectes columbarum*) superficially described by Dr. Anton Zürn in 'Die Krankheiten des Hausgeflügels.'

He evidently knows but little about the mite, but quotes from Megnin and others and gives one or two rather suggestive hints which it is expected will soon be worked out by ex-

periments among the birds in the New York Zoological Society's collection.

Speaking of this mite, Zürn says: "Wohnort. Im Unterhautzellgewebe, ferner im Bauchfell, in den serösen Überzügen der Eingeweide, in dem Bindegewebe, welches die grösseren Blutgefässe, namentlich die Aorta, umgibt, bei Tauben und einigen wildlebenden Vögeln." In all the birds which have come under my observation the mites have been absolutely confined to an irregular patch on each side of the breast-bone.

Another paragraph of interest follows: "*Hypodectes columbarum* ist keine fertig entwickelte Milbe, sondern die Larve einer solchen. Megnin hält sie für die Nymphe einer ungekannten Milbe, wahrscheinlich eines *Pterolichus*. Der genannte Forscher will eine solche wurmförmige Larve oder Nymphe auf einem sich mausernden Vogel beobachtet haben, wie sie in die klaffenden Follikel der ausgefallenen Federn eindrang; * * * Ist die Mauser vorüber, dann nehmen die Nymphen die normale Form an, indem sie sich aus ihren Hüllen befreien und auf die Oberfläche der Haut wandern."

This subdermal form may be the immature stage of an arthropod with incomplete metamorphosis, and as the birds afflicted had passed their moult, the fact that entrance was gained through a gaping feather follicle is not impossible. The hairs on the legs of these organisms would certainly seem to suggest that part, at least, of their existence is spent where these would be of more use than in an inch or two of subcutaneous tissue.

In two living ibises incisions in the skin of the breast were made, and by pushing the skin back and forth near the pectoral muscle, to which it is so loosely attached, a number of very small mites were 'teased' into view, but these birds have shown no ill effects from them.

If the ravages of these mites ever become again troublesome, the treatment suggests itself of injecting or applying some liquid inimical to parasites, as iodine, during the moulting of the birds which seem to be particularly susceptible.

Attempts to inoculate pigeons have not thus far been made, as in dead birds the parasites have been also without life, and the living birds which have been examined have been too valuable to warrant any extensive incision for the purpose of obtaining living mites.

C. WILLIAM BEEBE.

March 18, 1902.

NOTE ON DISCORBINA RUGOSA D'ORBIGNY, FROM PROVINCETOWN, CAPE COD.

THROUGH the courtesy of Professor J. Henry Blake, of Harvard, the writer recently received a number of specimens of Foraminifera from various localities. Among this material was some shore sand from Provincetown, Cape Cod, Mass., which contained a large number of foraminifera. Upon examination these were found to belong to a single species, namely *Discorbina rugosa* d'Orbigny.

The species is a particularly interesting one, since it does not appear to be at all common at the present time. The *Challenger* Expedition obtained the species from only two stations: off Papua, near Raine Island, depth 155 fathoms, and off Ki Island, 580 fathoms.

D'Orbigny in his report in 1839 on the Foraminiferes American Meridonale, described the shell under the name *Rosalina rugosa* from the Bay of St. Blas, Patagonia.

In the 'Challenger Report' Brady describes the shell as follows: "A more or less explanate modification of *Discorbina* resembling *Anomalina ammonoides* in general contour. The test is compressed and exhibits some approach to bilateral symmetry, and the peripheral edge is round and lobulated. The umbilical cavity of the inferior side is partially covered in by valvular flaps protecting the successive apertures."

This shell is very abundant in the Cape Cod shore sand at Provincetown, but the writer was unable to find a single specimen in some material submitted from Woods Holl. A more thorough examination may perhaps reveal the shell in other localities along the Atlantic coast, but it is probably confined to northern waters. Our specimens are large, well developed, of a dark brownish color and in a state of perfect preservation.

RUFUS M. BAGG, JR.

BROCKTON, MASS.

THE PROPER NAME OF THE ATLANTIC BOTTLENOSE WHALE.

THE binomial long applied to the 'bottlenose' of the Atlantic Ocean and currently accepted by modern authors is *Hyperoodon rostratus* (Muller), described and named *Balæna rostrata* by him in 1776 in the 'Zool. Dan. Prodr.,' p. 7. This appears to be antedated six years by *Balæna ampullata,* a name proposed for the same animal by John Reinhold Forster in the 'Linnæan Travels' [Kalm], 1770, Vol. 1, p. 18, footnote. In this Forster criticizes Kalm for calling the 'bottlenose' a dolphin, because 'it has no teeth in its mouth as all the fish of that class have.' He then refers to "Mr. Pennant's 'British Zoology,' Vol. 3, p. 43, where it is called the beaked whale and very well described," adding, "a drawing is seen in the explanatory table, n. 1. Perhaps it would not be improper to call it *Balæna ampullata* F." In the 1812 edition of Pennant's 'British Zoology,' Vol. 3, p. 85, this 'beaked whale' or 'bottle head' is properly classed under Lacepede's genus *Hyperoodon.* From the foregoing I conclude the proper name of this whale to be *Hyperoodon ampullatus* (Forster).

SAMUEL N. RHOADS.

AUDUBON, N. J.,
March 19, 1902.

CURRENT NOTES ON METEOROLOGY.

LOSS OF LIFE IN THE UNITED STATES BY LIGHTNING.

THE Weather Bureau has, since 1890, conducted a statistical inquiry into the number of deaths and of injuries caused by lightning in the United States. This work has been carried on up to the close of 1900, when it was discontinued. During the year 1900, 713 persons were killed by, or received fatal injuries through, lightning. Of this number 291 persons were killed in the open, 158 in houses, 57 under trees, and 56 in barns. The circumstances attending the deaths of the remaining 151 are not known. During the same year 973 persons were more or less injured by lightning strokes. On the average, it is probable that from 700 to 800 lives are lost each year by lightning in the United States. Tabulating the average mortality resulting from lightning according to geographic districts subject to the same, or nearly the same, atmospheric conditions, it appears that the greatest number of fatal cases occurred in the Middle Atlantic States; the next greatest in the Ohio Valley and Tennessee, with the middle and upper Mississippi Valley a close third. The greatest number of deaths in any single state during the five years 1896-1900 occurred in Pennsylvania (186), followed by Ohio with 135, and Indiana, Illinois and New York with 124 each.

In the Gulf States the average number of deaths due to lightning per unit area (10,000 square miles) is 1. In New England, with probably half as many thunderstorms, the death rate per unit area is 2. In the latter district the death rate per million of rural inhabitants is nearly double that per million of total population, and the same holds true of the densely populated districts of the Middle Atlantic States. Considering both unit area and density of population, the greatest mortality by lightning is in the Ohio Valley and the Middle Atlantic States. If, however, the density of population alone be considered, it is in the upper Missouri valley and the middle Rocky Mountain region.

The foregoing facts are taken from Bulletin 30, of the Weather Bureau ('Loss of Life in the United States by Lightning,' by A. J. Henry), in which will be found further interesting information, as well as a chart—the first of its kind for this country—showing the geographic distribution of deaths by lightning in the United States.

TEMPERATURE, RAINFALL AND SUN-SPOTS IN JAMAICA.

MAXWELL HALL returns to the subject of the relation between sun-spots, temperature and rainfall in a recent paper entitled 'Temperatures in Kingston, Jamaica, and the Connection between Sun-Spot Frequency, the Mean Maximum Temperature, and the Rainfall in Jamaica' (Kingston, 1902, 12 pp.). Using the observations of 1881–1898, inclusive, and taking the mean maximum temperatures of any three years as the mean of the middle year, the plotted curve of mean maximum

temperatures agrees remarkably closely with the curve of sun-spot frequency. There are about 2° in mean maximum temperature between the maximum and minimum of the sun-spot curve. The rainfall curve also accords as a whole remarkably closely with the sun-spot curve, but from the middle of 1887 to the middle of 1890 the rainfall was less than it should have been, and from the middle of 1891 to the end of 1895 it was greater than it should have been. These irregularities are interesting because in 1892 it was assumed that the curve would recover its position, and a smaller rainfall for the next few years was predicted, but 1893 proved to be unusually wet.

CLIMATE OF WESTERN AUSTRALIA.

CLIMATOLOGISTS will give the latest publication from the Perth Observatory a warm welcome, for it is the first comprehensive report on the climate of western Australia. Annual meteorological summaries have been issued since 1876, but the present volume comprises a selection and coordination of the principal meteorological facts which have been discovered during the past twenty-four years of observations. 'The Climate of Western Australia from Meteorological Observations made during the Years 1876-1899' is the title of this publication, and it reflects great credit on Mr. Ernest Cooke, Government Astronomer for Western Australia. Naturally, meteorological work has been carried on under the greatest difficulties in the district in question, and the earlier records cannot be compared as regards accuracy with those which are now being made.

It is a great satisfaction to note that Mr. Cooke gives at the very beginning of his report a series of seventeen weather maps illustrating the weather types of the district under discussion, for the best understanding of a climate is to be gained through an appreciation of the local weather types. There are two principal types of weather, the winter and the summer, although each of these is, of course, subject to endless modifications. A general, albeit very brief, description of the climate follows the discussion of the weather types, the statements having special reference to Perth, and a full set of meteorological tables completes the volume. A table of special interest is that which shows the duration of the 'heat waves' which have passed Perth since January 1, 1880. The longest of these spells without a break occurred in 1896, when the maximum temperature exceeded 90° on every day between January 25 and February 12—nineteen days in all, but the most severe heat was apparently in January and February, 1880, when the maxima on several days rose over 100°, and on two days over 110°. It may be noted, however, that hot nights are exceptional, even during these hot waves, the minima being usually between 60° and 70°. A series of charts accompanies the volume, showing, for each month and for the year, the pressure; mean, maximum and minimum temperature, and the rainfall.

R. DEC. WARD.

HARVARD UNIVERSITY.

SCIENTIFIC NOTES AND NEWS.

THE Academy of Sciences at Christiania has elected the following corresponding members: Dr. J. H. van't Hoff, professor of general chemistry, and Professor Adolf Engler, professor of botany, at the University of Berlin; Dr. Richard Abegg, professor of chemistry at Breslau; Dr. Karl A. Ritter von Zittel, professor of paleontology and geology at Munich, and Dr. Julius Hann, professor of meteorology at Vienna.

MCGILL UNIVERSITY has conferred the degree of doctor of science in course on Professor Frank Dawson Adams, M.A., Ph.D., Logan professor of geology and paleontology, McGill University, and on William Bell Dawson, M.A., Ma.E., of the Department of Marine, Ottawa.

GLASGOW UNIVERSITY has conferred its LL.D. on Mr. James Stevenson, of Largs, for his services in opening up Nyassaland and in establishing the Livingstone mission by which the work of Dr. Livingstone was continued and brought to fruition, and in the completion of the great highway between Lake Nyassa and Tanganyika, known as Stevenson-road.

PROFESSORS VICTOR C. VAUGHAN and Frederick G. Novy of the medical department of the

University of Michigan will leave for Asia about the middle of June to investigate tropical dysentery.

We regret to learn that President Henry Morton, of Stevens Institute of Technology, Hoboken, has suffered a relapse following the surgical operation he underwent on April 15.

Mr. William S. Weedon, L.B., Maryland Agricultural College, 1897, assistant in chemistry at the Johns Hopkins University and a candidate for the doctorate of philosophy in June, has been appointed research chemist of the General Electric Company, Schenectady, N. Y.

Dr. F. A. Bather has been promoted to the assistant keepership of the Department of Geology in the British Museum (Natural History).

Professor Charles Aurivillius has been elected permanent secretary of the Royal Academy of Sciences at Stockholm, and Dr. Yngve Sjöstedt has been made professor in the Academy and custodian of the entomological department of the Museum of Natural History.

Sir William Roberts-Austen gave the tenth James Forrest lecture before the Institution of Civil Engineers of London on April 23, his subject being the 'Relations between Metallurgy and Engineering.'

During the coming season four field parties will be sent out from the department of vertebrate paleontology of the Carnegie Museum at Pittsburg, Pa. These parties will be under the general direction of Mr. J. B. Hatcher, and will be assigned as follows: One under the direct charge of Mr. Peterson will continue the exploration of the Tertiary deposits of northwestern Nebraska; a second, in charge of Mr. C. W. Gilmore, will carry on the work in the Jurassic deposits on Sheep Creek, Wyoming, where such excellent results have already been obtained by this museum during the past three years; a third, with Mr. W. H. Utterback in charge, will work in the Laramie of Wyoming and Montana; while Mr. Earle Douglass, who has recently been engaged by this museum, will undertake a systematic exploration of the various Tertiary horizons discovered by him in western Montana. It is proposed to continue Mr. Douglass in this field until he has accumulated sufficient material and data to enable him to definitely correlate the various horizons and to monograph the fauna of each.

Nature states that the meeting of the Paris Academy of Sciences on April 14 was adjourned as a sign of respect for the late Professor A. Cornu, whose untimely death was announced by the president in the following words:

> The Academy of Sciences has suffered a great loss. Professor Cornu died on Friday, carried away rapidly by a disease which no one could foresee would terminate so sorrowfully. Our colleague was relatively young; he entered the École Polytechnique in 1860 and was nominated a member of our Academy in 1878, at thirty-seven years of age. Esteemed as a professor at the École Polytechnique, and contributing to the Bureau des Longitudes every year notices written in perfect language, he died while in active scientific work, leaving saddened parents and friends behind him, and universal regret in the scientific world.

We regret to record the deaths of Dr. Alexander Bittner, chief geologist in the Imperial Geological Institute at Vienna, and of Dr. Egon Müller, docent in physics at the University at Erlangen.

The astronomical library and collection of photographs, drawings, etc., belonging to the late Miss Catherine M. Bruce, to whom astronomy was indebted for many generous gifts, has been presented to the Allegheny Observatory by her sister, Miss M. W. Bruce.

A despatch from Wellington says the government has provided $5,000 for an antarctic relief ship.

The first conversazione of the Royal Society for this session will be given at Burlington House on Wednesday, May 14, at 9 P.M.

The agricultural experiment station of the University of Illinois in cooperation with the Bureau of Soils of the U. S. Department of Agriculture is beginning an agricultural survey of Illinois soils. A field party is now at work in Tazewell County. In conducting the

survey the ground is gone over carefully and the soil is examined to a depth of from three to six feet, samples being obtained by boring with augers. Soil maps will be made which will show the area and location of all the different important types or classes of soil in the land surveyed.

THE commission authorized by the late New York legislature to report on the establishment of a state electrical laboratory, met at Albany on April 29.

IT has for some time been understood that the Louisiana Purchase Exposition at St. Louis will not be held before 1904, and the executive committee has requested congress to change the time of the exposition from 1903 to 1904.

THE nineteenth annual meeting of the American Climatological Association will be held at Los Angeles, Cal., on June 9–11, under the presidency of Dr. Samuel A. Fisk, of Denver.

THE Easter vacation party at the Port Erin Biological Station, says *Nature,* has suffered by the absence abroad of Professor Herdman and Mr. I. C. Thompson, so that it was not possible to arrange any steam dredging expeditions. Nevertheless, much good work has been done on the shore and with the townet, and several workers have spent a profitable vacation at the station. These include Dr. Darbishire, Miss Pratt and Miss Drey from Owens College, Messrs. Pearson and Tattersall from University College, Liverpool, and Mr. Laurie from Oxford. Mr. Cole was to have conducted a vacation class, but was unable to cross owing to a family bereavement. The new and greatly improved station is progressing rapidly and will be opened in the summer.

MUCH additional material from the A. J. Stone Expedition to Alaska has been received recently by the American Museum of Natural History among which there are specimens of what proves to be a fine new species of caribou and a new species or subspecies of mountain sheep. This expedition is the first of a series made possible through the efforts of Madison Grant, Esq., and supported by him and other friends of the Museum, for the purpose of securing an adequate representation of the game mammals of the continent. The past season's work has been especially important because it has provided material from Alaska, a portion of America heretofore practically unrepresented in the collections.

NEWS has been received to the effect that the expedition headed by Mr. W. F. Whitehouse of Newport, R. I., who is accompanied by Lord Hindlip, reached Gildessa on the Abyssinian frontier, on March 23, with the members in good health, and proceeded to Adis Abeba, capital of Abyssinia.

PLANS for the auxiliary Baldwin-Zeigler expedition to northern polar regions have been completed and the men who have been intrusted with its direction will shortly leave for Europe. The steamer *Frithjof,* which with the *America* conveyed the Baldwin party to Franz Josef land, will depart from Tromsöe on July 1. The auxiliary expedition will be in charge of Mr. W. S. Champ, secretary to Mr. William Zeigler, who will sail for Europe on the steamship *Cymric* on May 23, and the remainder of the party will leave on the steamship *Pretoria* on June 7.

THE Horticultural Society of New York will hold its third annual meeting at the New York Botanical Garden on May 14. Members and their friends leaving Grand Central station by the 1:35 P.M. train for Bronx Park, will be met at the station by Mr. James Wood, president of the Society, and escorted to the conservatories. Those leaving Grand Central Station by the 2:35 P.M. train will be met by Dr. D. T. MacDougal, first assistant, New York Botanical Garden, and escorted to the conservatories. Leaving the conservatories at 3:35 the party will walk through the grounds to the museum building; the formal meeting will commence in the lecture hall of the museum building at 4:15 o'clock and will be followed by an exhibition by Dr. N. L. Britton, of lantern slides illustrating 'Features of the New Zealand Flora,' contributed to the Garden by Mr. L. Cockayne. The Council of the Society will meet in the administration office, museum building, at 3:15 o'clock. The mu-

seum, library, herbarium, and laboratories in the museum building will be open for inspection until 6:30. An exhibition will be held in connection with the meeting, in the hall of the museum building immediately adjoining the lecture hall; this exhibition will be open from one o'clock until half past six on Wednesday, May 14, and from ten o'clock until five on Thursday, May 15.

UNIVERSITY AND EDUCATIONAL NEWS.

Adelphi College, Brooklyn, has received gifts amounting to $250,000, of which one half was given by Mr. John D. Rockefeller.

Mr. Henry C. Havemeyer has given two thousand volumes to the library of the public school at Greenwich, Conn., erected by him and Mrs. Havemeyer at a cost of $200,000.

Three of the positions offered by the Harvard Medical School to properly qualified men desirous of training in physiological research and in the management of large laboratory classes in experimental physiology are not yet filled for the next collegiate year. Holders of these positions give more than half the day to research. The remaining time is spent during the first four months of the collegiate year in learning laboratory methods and during the last four months in directing the laboratory work of the medical students, about two hundred of whom work from two to three hours daily for sixteen weeks in experimental physiology. The fundamental experiments in physiology done by so many men working at one time present every variety of results and impart a training not to be acquired in other ways. Much too may be learned by association with the large staff engaged in research in the laboratories of anatomy, histology, pathology, pharmacology, hygiene, physiology and physiological chemistry, all of which have their laboratories in the Medical School building. No charge of any kind is made either for the training in physiological research and in teaching or for the use of animals and other material. In addition to these opportunities each assistant receives four hundred dollars. Applications for these positions should be sent to Professor W. T. Porter, Harvard Medical School, 688 Boylston Street, Boston, Massachusetts.

The Hon. Carroll D. Wright, commissioner of labor, has been appointed president of the collegiate department of Clark University. It is understood that Mr. Wright will not, for the present at least, resign his position under the government or his work at Columbian or Catholic University.

Dr. Frank Strong, formerly president of the University of Oregon, has been elected chancellor of the University of Kansas.

It is expected that General Webb, president of the College of the City of New York, will retire from his office at the end of the present year. Arrangements have this winter been made by which the officers of the College retired for age shall receive a liberal pension. The report that Dr. W. H. Maxwell, superintendent of public schools, will succeed General Webb is said to have no definite foundation.

Professor Lachman, of the University of Oregon, has been invited to take charge of the chemical department at the University of California for the coming summer session.

Dr. Frank R. Van Horn has been appointed professor of geology and mineralogy at Case School of Applied Science, Cleveland, Ohio.

Dr. W. B. Huff, instructor in physics in the Johns Hopkins University, has been appointed associate in physics at Bryn Mawr College. Dr. Huff received his baccalaureate degree at the University of Wisconsin in 1889, his master's degree at the University of Chicago in 1896, and his doctorate at Johns Hopkins in 1900.

Dr. Fournier has been appointed professor of geology and mineralogy in the University of Besançon. Dr. v. Nathusius, docent in agriculture at Heidelberg, has been called to an assistant professorship at Jena. Dr. Wöhler has qualified as docent in inorganic chemistry in the Technical Institute at Charlottenburg and Dr. Brunner as docent in physical chemistry in the University of Lemberg.